

# **A Methodological Framework for Policy Design & Analysis Focusing on Problem Identification & Investigation**

**Catherine Teehan**

**School of Computer Science and Informatics**

**Cardiff University**

This thesis is submitted in partial fulfilment of the requirement for the degree  
of Doctor of Philosophy

**October 2018**

## **Abstract**

Traditional public policy decision making has been supported with a cyclical framework based on the rational model, first introduced in the 1950s by Harold Lasswell. However, public policy problems are intrinsically complex and are usually inherently multi-disciplinary and critics of the cyclical model call for more holistic approaches to public policy decision making to address this complexity. This means methodologies, tools and techniques that support multiple perspectives, involve multiple stakeholders and require multiple sources of information are essential for the investigation, analysis and support of public policy decision making. The proposed framework presented in this thesis has been developed to address the issues arising when investigating public policy problems. It addresses the complexity and multiplicity that is public policy decision making, concentrating on problem identification and definition.

There is a presentation of the existing frameworks for policy decision making and their limitations. It discusses issues with problem recognition and definition and proposes a methodological framework that provides a thorough investigation into the problem domain to identify areas for policy actions, critical information needs and enables simulation and experimentation to identify unintended consequences.

Traditional approaches to policy decision making have been criticised for failing to take into account the wealth of information generated and used by the policy process. This has led to the emergence of Policy Informatics as a new field of research.

This thesis shows that a methodological framework for policy design and analysis can be created, based on the core concepts of Policy Informatics and Systems Thinking, that more thoroughly investigates the problem space than previous approaches and addresses common issues with problem recognition and definition that exist in more traditional policy decision making frameworks.

## Acknowledgements

I would first like to express my gratitude to my supervisors, Steve McIntosh for starting me on this road and instilling a passion for Systems Thinking, Professor Alex Gray for taking up the reigns and providing expert guidance, red pen, late night consultations and constant support, and Dr Wendy Ivins for the pastoral care, gentle nudges in the right direction and, of course, the coffee and cappuccino cake.

Thanks go to all my colleagues in the School of Computer Science and Informatics and my PhD peers, especially those who have encouraged alcohol fuelled celebrations of the tiniest achievements (you know who you are Lowri and Liam!). Special acknowledgements go to Dr Leigh Hodge, for his endless support as my line manager, and allowing me the flexibility to complete this project, to Tracey Lavis who is constant source of encouragement and chocolate, and to Professor Stuart Allen and Dr Rob Davies who have both pushed and encouraged me in equal measure, to be my better self.

Special thanks go to my friends and family for their unwavering support and encouragement, Clare, Kelly and Mel for the hilarity that is Wednesday night catch up, Annelies for eye-rolling 'of course you can do it', and to Darren for putting up with my pen-clicking, pacing whilst trying to write a sentence that makes sense.

I would also like to thank Professor Brian Wilson for sanity checking my SSM and to the many participants involved in shaping this research, with a special thanks to Emer McAllister for her candid input.

## Acronyms

Institutional Analysis and Development (IAD)

Conceptual Model (CM)

Consensus Primary Task Models (CPTM)

Environment Agency Wales (EAW)

Home Box Office (HBO)

Human Activity Systems' (HAS)

Human Resource (HR)

International Council On Systems Engineering (INCOSE)

Institutional Rational Choice (IRC)

Mixed Scanning Model (MSM)

Multiple Stream Analysis (MSA)

Narrative Policy Framework (NPF)

Normal Accident Theory (NAT)

Operational Research (OR)

Office of National Statistics (ONS)

policy fundamentals' (PFs)

policy tests (PTs)

Problem Structuring Methods (PSMs)

Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback  
(ROAMEF)

Root Definitions (RDs)

Soft Systems Methodology (SSM)

Soft System Dynamics Methodology (SSDM)

Strategic Choice Approach (SCA)

Strategic Options Development and Analysis (SODA)

System Dynamics (SD)

Systems of Systems Approach (SoSA)

Viable Systems Model (VSM)

Voluntary Sector Organisation (VSO)

## Table of Figures

Figure 1: Policy Cycle based on the ‘Rational Model’ .....	34
Figure 2: The ROAMEF Cycle from (Hallsworth 2011b) .....	37
Figure 3: A general conception of a “system” .....	42
Figure 4: The Viable Systems Model .....	86
Figure 5: The 7 Stages of SSM.....	88
Figure 6: The information/action/consequence paradigm of system dynamics (Coyle 1996) .....	92
Figure 7: Policy Decision Making Cyclical Model .....	104
Figure 8: Detailing the methodological choices that can be added to existing frameworks .....	107
Figure 9: Influence Diagram taken from inquiry transcripts .....	121
Figure 10: Influence Diagram with Loops Identified .....	122
Figure 11: The use of SD in the Framework .....	132
Figure 12: The use of SSM in the Framework.....	136
Figure 13: The use of SD to support Policy Decision-Making .....	137
Figure 14: PM10 Policy Model .....	138
Figure 15: Decision Element of PM10 Policy Model .....	139
Figure 16: Modular Emissions Diagram .....	140
Figure 17: Using SSM, SOSA and SD .....	141
Figure 18: Activity Framework.....	149
Figure 19: A Proposed Framework for Policy Design & Analysis.....	151
Figure 20: ID created from "Problematizing Every Child Matters" .....	156
Figure 21: Influence Diagram taken from social worker interviews .....	157
Figure 22: Social worker interview ID with loops identified .....	158

Figure 23: Diagram Detailing the Focus for Developing the SSM Models .	160
Figure 24: Enterprise Model as taken from B. Wilson (2002).....	162
Figure 25: S1 Conceptual Model.....	170
Figure 26: S2 Conceptual Model.....	171
Figure 27: S5 Conceptual Model.....	172
Figure 28: The Synthesising of SSM and SD.....	173
Figure 29: Child Protection Organisational Model.....	175
Figure 30: HR Management Influence Diagram showing factors from Case Management Influence Diagram .....	176
Figure 31: Relationship between SSM conceptual model and SD Influence Diagram .....	178
Figure 32: HR Management Influence Diagram.....	179
Figure 33: Diagram of Information Categorisation .....	183
Figure 34: HR Management Information Mapping .....	184
Figure 35: HR Management snap shot with hiring policy .....	184
Figure 36: Munro's Model of Child Protection taken from "The Munro Review of Child Protection, Part One: A Systems Analysis" .....	201
Figure 37: Influence Diagram created as a comparison to Munro's model	204
Figure 38: HR Management Simulation Model .....	212
Figure 39: Case Management Simulation Diagram .....	213
Figure 40: Result of Example Experiment on Social Workers Needed .....	216
Figure 41: Graph Showing Impact of Stress on Days lost Through Sick Absence.....	217
Figure 42: Graph Showing the Impact of Reduced Caseloads on Children Waiting for a Social Worker Allocation .....	218



## Table of Tables

Table 1: Summary of Public Policy Theories .....	31
Table 2: Comparison of PSMs .....	95
Table 3: Summary of Mixed Methodologies .....	101
Table 4: Participant Information Table .....	149
Table 5: The Department for Education - 5 Policy Tests.....	193
Table 6: Evaluation of Proposed Framework against PFs and PTs .....	194
Table 7: Performance Information Set as taken from 'The Munro Review of Child Protection: Final Report' 2011 .....	206
Table 8: Information Items Identified in Moving from Qualitative to Quantitative Modelling .....	209

# Table of Contents

Abstract.....	i
Acknowledgements.....	iii
Acronyms.....	iv
Table of Figures.....	vi
Table of Tables.....	viii
Table of Contents.....	ix
Chapter 1 – Introduction .....	1
1.1 – Introduction.....	1
1.2 – Historical Background to the Research .....	2
1.3 – The Problem with ‘Problems’ .....	2
1.4 – Research Goals and Contributions.....	3
1.4.1 – Motivations for the Research .....	3
1.4.2 – Research Hypothesis.....	4
1.4.3 – Objectives needed to test the research question: .....	5
1.4.4 – Steps needed to achieve objectives.....	5
1.4.5 – Contribution to Research .....	7
1.5 – Thesis Structure .....	7
Chapter 2 – Motivation and Scope.....	12
2.1 – Introduction.....	12

2.2 – Understanding the Issues.....	12
2.3 – Developing a Deeper Understanding .....	15
2.4 - Exploring Potential Solutions.....	16
2.5 – Deriving the Scope .....	17
2.6 – Conclusion.....	20
Chapter 3 – The Subject of Public Policy and Policy Decision Making .....	23
3.1 – Introduction.....	23
3.2 – The Theories of Public Policy .....	24
3.2.1 – Multiple Stream Analysis (MSA) .....	25
3.2.2 – Social Construction and Policy Design (SCF) .....	26
3.2.3 – Narrative Policy Framework (NPF) .....	28
3.2.4 – Institutional Analysis and Development Framework (IAD) .....	28
3.2.5 – Summary of Theories of Public Policy .....	29
3.3 – Policy Models .....	32
3.3.1 – The Incremental Model (IM).....	32
3.3.2 – The Cyclical Models.....	33
3.3.2.1 – The Rationalist Model (Jones & Baumgartner 2005) .....	35
3.3.2.2 – The ROAMEF Framework (Hallsworth & Rutter 2011) .....	36
3.3.3 – Mixed Scanning Model.....	38
3.3.4 – The Systems Model .....	39
3.3.4.1 – System Characteristics .....	40
3.3.5 – Summary of Policy Models .....	42
3.4 – The Stages of the Policy Cyclical Model.....	44

3.4.1 – Agenda Setting .....	44
3.4.2 – Policy Formulation .....	47
3.4.3 - Implementation .....	48
3.4.4 – Evaluation .....	51
3.4.5 – Policy Adaptation and Termination .....	52
3.5 – Conclusion.....	53
Chapter 4 – Policy Information and Policy Informatics.....	54
4.1 – Introduction.....	54
4.2 – The Use of Information in Public Policy Decision Making.....	54
4.3 – Information Quality .....	57
4.3.1 – Data Quality .....	58
4.4 – Information Fitness for Purpose .....	61
4.5 – Policy Informatics .....	63
4.5.1 – Theoretical Grounding of Policy Informatics .....	64
4.5.1.1 – Behavioural Economics .....	64
4.5.1.2 – Systems Theory .....	65
4.5.2 – Clusters of Policy Informatics Research .....	66
4.5.2.1 – Analysis.....	67
4.5.2.2 – Administration .....	67
4.5.2.3 – Governance .....	67
4.6 – Conclusion.....	68
Chapter 5 – Developing an Alternative .....	69
5.1 – Introduction.....	69

5.2 – Critique of Past Work.....	69
5.2.1 – Barriers to Policy Decision Making.....	70
5.3 – The need for Change.....	74
5.3.1 – Policy Design .....	74
5.3.2 – Policy Analysis .....	75
5.4 – Establishing the Methodological Choice .....	76
5.4.1 – Operational Research .....	77
5.4.2 – Hard versus Soft Operational Research .....	78
5.4.3 – Policy Decision Making in the Context of OR.....	80
5.4.4 – An Exploration of Problem Structuring Methodologies (PSMs) .	82
5.4.4.1 – Strategic Choice Approach (SCA) .....	84
5.4.4.2 – Strategic Options Development and Analysis (SODA) .....	85
5.4.4.3 – Viable Systems Method (VSM).....	86
5.4.4.4 – Soft Systems Methodology (SSM).....	87
5.4.4.5. – System Dynamics (SD) as a PSM .....	91
5.4.4.5.1 – Negative Feedback Loops .....	92
5.4.4.5.2 – Positive Feedback Loops .....	93
5.4.4.6 – Summary of PSM Methodologies .....	94
5.4.5 – Mixing Methodologies: Toward a Multi-Methodological Approach	
.....	96
5.4.5.1 – SODA and SD .....	96
5.4.5.2 – SODA and SSM .....	98
5.4.5.3 – SSM and SD .....	99
5.4.5.4 – Mixing Methodologies Summary .....	101
5.5 – Developing a New Framework for Policy Design & Analysis .....	102
5.5.1 – Enriching the Policy Process .....	103

5.5.1.1 – Define the Problem .....	104
5.5.1.2 – Determine Evaluation Criteria .....	107
5.5.1.3 – Identify and Evaluate Alternative Policies .....	109
5.5.1.4 – Selection, Implementation and Evaluation of Preferred Policy .....	111
5.6 – Conclusion.....	112
Chapter 6 – Evolving and Applying the Framework .....	114
6.1 – Introduction.....	114
6.2 – Case Study Research.....	115
6.3 – Case Study 1 - The Mid-Staffordshire Case .....	117
6.3.1 – Loop Analysis .....	119
6.3.2 – Summary of Case Study 1 .....	131
6.4 – Case Study 2 – The Environment Agency Wales.....	132
6.4.1 – The Problem .....	132
6.4.2 – Applying SSM .....	133
6.4.3 – Applying SD .....	136
6.4.4 – Combining the Techniques .....	140
6.5 – Case Study 3 – Child Protective Social Services .....	141
6.5.1 – Background to Case Study 3 – Child Protection .....	142
6.5.2 – The Call for an Alternative Approach .....	142
6.5.3 – Social Care Informatics.....	146
6.5.4 – The New Framework and its Application to Child Protection ..	148
6.5.4.1 – Mapping Causality.....	152
6.5.4.2 – Identifying Critical Activities and Their Dependencies .....	153
6.5.4.3 – Simulation and Experimentation .....	153

6.5.4.4 – Establishing the Context .....	154
6.5.4.5 – Framing the Problem .....	159
6.5.4.5.1 – The Root Definitions .....	163
6.5.4.5.2 – The Conceptual Models .....	169
6.5.4.5.3 – The Organisational Model.....	173
6.5.4.6 – Identifying Information Needs and Information Analysis.....	177
6.6 – Conclusion.....	186
Chapter 7 – Analysis, Evaluation and Contribution .....	188
7.1 – Introduction.....	188
7.2 – Brooks’ ‘No Silver Bullet’ .....	189
7.2.1 – Complexity .....	190
7.2.2 – Conformity .....	191
7.2.3 – Changeability .....	196
7.2.4 – Visibility .....	197
7.3 – Analysis and Evaluation in the Case of Child Protection .....	199
7.3.1 – Producing and Evaluating the Qualitative Models.....	199
7.3.2 – Understanding the Information Needed for Producing the Quantitative Models .....	205
7.3.3 – Building the Simulation Diagrams .....	210
7.3.3.1 – Experiment Example: Caseload Related Recruitment .....	215
7.4 – Model Validation .....	219
7.4.1 – Accuracy of Representation.....	220
7.4.2 – Clarity of Purpose .....	221
7.4.3 – Demonstration of Usefulness .....	221

7.4.4 – Model Correctness.....	222
7.5 – Conclusion.....	224
Chapter 8 – Conclusion and Future Work.....	225
8.1 – Introduction.....	225
8.2 – Future Work.....	225
8.3 – Progress against Thesis Objectives .....	226
8.4 – Contribution to Research.....	228
References:.....	230
Appendix A – Small Individual Conceptual Models Created from the Root Definitions for Child Protection.....	238
Appendix B – Full size Consensus Primary Task Model.....	247
Appendix C – The Equations Created for the HR Management and Case Management Simulation Models.....	248
Equations for HR Management Model .....	248
Equations for Case Management Model .....	251



# **Chapter 1 – Introduction**

## **1.1 – Introduction**

In recent years public policy decision making has undergone significant challenges with an era of 'open' Government creating a more informed and critical society calling for more clarity in public policy decisions. Traditional frameworks for public policy decision making tend to be linear in nature and commonly lack robust investigation into the problem domain to clearly identify and define the problem being addressed with a policy action. There are also issues regarding demonstrating how the rationale behind a policy choice links to the outcomes of that policy choice. This is very clear in the Mid-Staffordshire case (Daily Mail, 2011), where the causes for the increased death rate at the hospital can be directly attributed to the policy decision to introduce 'wait-time' limits at the Accident and Emergency Department. The 'wait-time' limit was a policy introduced as a measure to improve patient care but resulted in significant failings in patient care thus exacerbating the problem the policy was intended to address.

The information available to inform public policy decision making is plentiful and comes from a rich variety of sources in various formats, yet, for such an information rich environment, little attention is given to that information.

There is a review in this thesis of the common public policy decision making theories, models and frameworks with discussion of their limitations. Also discussed is the lack of attention paid to the information used in the process of public policy decision making and how this has led to the evolution of Policy Informatics as a field of research. These discussions identify a clear

need for a framework for policy design and analysis that is holistic in nature and has a clearly defined methodological approach to robust investigation into the problem space. Within that framework is a focus on the information used to support the policy decision making process and inform the policy decisions made.

## **1.2 – Historical Background to the Research**

“Toward the end of the Second World War, a new consciousness arose amongst the public and policy makers of the Western World. After ten years of crippling economic depression and another five at war, the public demanded something new from their disintegrating urban environments.” — Lucas Mascotto-Carbone

The advent of the Second World War brought a new era of research in the form of Operational Research to focus on effective decision making. This led to the development of the Rationalist Model of decision making which still forms the basis for public policy decision making today (Fischer et al. 2007). Though the model and the cyclical framework that utilises the Rationalist Model have evolved over the years, the core stages are consistent. This thesis reviews the core stages of the traditional cyclical models of policy decision making and highlights where issues lie with problem recognition and definition.

## **1.3 – The Problem with ‘Problems’**

The first stage of the cyclical models deals with problem recognition and definition. However, this is commonly the most overlooked stage of the policy process as it becomes more focussed on ‘agenda setting’. The

problem with redefining this stage as ‘agenda setting’ is this assumes that the problem has already been clearly defined. The research into this area, discussed in Chapter 2, leads to a conclusion that, all too frequently, the policy process continues with what the problem is *perceived* to be rather than what it *actually* is as this has not been identified. This leads to a need for problem recognition and a more thorough investigation of the problem domain. The thesis presents an alternative framework for policy design and analysis that provides such an investigation. This investigation includes the mapping of causality within a problem domain to identify where policy action should be focussed and to test the outcomes of a proposed policy action. The main contribution of this thesis is the development of a framework for policy design and analysis that provides a clear process for problem identification, definition and investigation.

## **1.4 – Research Goals and Contributions**

After briefly discussing the historical background to the cyclical policy framework, and particularly problem definition, this section focuses on the primary motivations for the research. It introduces the research hypothesis being investigated and discusses the objectives developed because of the research hypothesis. It also briefly discusses the contribution to research made by this thesis.

### **1.4.1 – Motivations for the Research**

The main objective of this research is to provide a framework method for public policy decision-making that improves decisions measured by economic, sociological and environmental factors. The principal motivation

is to address the issues with the more traditional cyclical frameworks for policy decision making, particularly in relation to problem recognition, definition and investigation. By providing an alternative framework with detailed methodological choices, a more thorough investigation into the problem domain can be conducted. This results in policy action that solves the *actual* problem rather than the *perceived* problem.

### **1.4.2 – Research Hypothesis**

The hypothesis at the core of the research is:

*It is possible to create a methodological framework for policy design and analysis that provides a clear process for policy problem identification, definition and investigation that addresses common issues which arise when using traditional cyclical policy frameworks*

The review of the traditional cyclical frameworks used in public policy decision making identified several issues:

- Problems are not clearly recognisable by the outcomes of policy action
- Problems are assumed rather than clearly defined
- Causality is not considered as part of problem recognition
- There is a lack of a consistent methodological approach to policy making

Whilst it is recognised that frameworks exist for policy design and policy analysis, these frameworks do not detail the methodological choice to

support the stages of those frameworks. Key to this research is the methodological choice and what it adds to the proposed framework.

### **1.4.3 – Objectives needed to test the research question:**

The objectives of the research described in the main body of this thesis are:

1. Understand the area of public policy decision making and the frameworks that support it
2. Review the field of policy informatics to improving the policy decision making process
3. Develop a domain-independent methodological framework for policy design and analysis
4. Identify an appropriate case study
5. Apply the methodological framework to the case study
6. Demonstrate how the application of the methodological framework supports the answering of the research questions by improving investigation into the problem space

### **1.4.4 – Steps needed to achieve objectives**

Objective 1 - Understand the area of public policy decision making and the frameworks that support it

- Define what is meant by public policy decision making
- Identify theories, frameworks and models used in public policy decision making
- Understand the weaknesses and strengths of the frameworks

Objective 2 - Understand the role of information in the policy process and in the context of policy informatics

- Undertake a literature review of policy informatics
- Undertake and assess the methodologies that can be considered appropriate for a Policy Informatics approach

Objective 3 - Develop a domain-independent methodological framework for policy design and analysis

- Complete research into appropriate methodological tools that support policy decision making
- Identify where its use is appropriate in the context of the existing frameworks and the effect it would have
- Demonstrate how the methodological choices add richness to existing framework
- Demonstrate how the methodological choices evolve into a new framework for policy design and analysis

Objective 4 - Identify an appropriate case study

- Understand the complexity of public policy decision making to ensure the chosen case study represents the nature of public policy decisions
- Ensure the case study has the necessary complexity to fully test the developed methodological framework
- Detail the issues with the chosen case study and why it could be considered problematic
- Assess availability and quality of data

Objective 5 - Apply the methodological approach to the case study

- Test the elements of the framework using an appropriate case study
- Identify an independent tool for evaluating the framework against existing frameworks.

Objective 6 - Demonstrate how the applying of the methodological framework supports the answering of the research questions by improving investigation into the problem space

- Identify the policy action, information requirements and measures of performance associated with the chosen case studies
- Evaluate the effectiveness of the framework using an identified independent evaluation tool

#### **1.4.5 – Contribution to Research**

The main body of this thesis details the achievement of the above objectives. In doing this, it provides a demonstration of where the proposed methodological framework for policy analysis and design leads to a thorough investigation into the problem space. It is important to stress that, although a complete framework is proposed, the testing of this framework is limited to the early stages of establishing the context and framing the problem. This focus has been chosen as it addresses the issues with problem recognition and definition found in traditional cyclical policy decision making frameworks.

#### **1.5 – Thesis Structure**

The thesis structure is:

## **Chapter 2 – Motivation and Scope**

Chapter 2 provides an overview of the research and thesis. It discusses the motivation for the research and defines the scope. The discussion introduces the case studies used and how they were used to develop understanding and shape the thinking that led to the formulation of a new framework for policy design and analysis that focuses on problem identification and investigation.

## **Chapter 3 – The Subject of Public Policy and Policy Decision Making**

Before work can proceed with a view to proving the research hypothesis, an investigation into public policy and public policy decision making is required. The focus in this chapter is establishing which frameworks for public policy decision making are most commonly used and understanding their limitations. This chapter also considers the theoretical grounding of public policy to understand how this applies to the frameworks used and guide the thinking behind the development of an alternative framework.

## **Chapter 4 – Policy Information and Policy Informatics**

Having gained an understanding of the background of public policy theories, models and frameworks, this chapter looks forward to the evolution of Policy Informatics as a field of research and its implication for policy decision making. The chapter focusses on the information generated and utilised in the formation of public policy and discusses the issues with information quality and fitness for purpose when that information is used to support the public policy decision making process.



## **Chapter 5 – Developing an Alternative Approach**

This chapter provides a critique of past work in the field of policy science, policy theories and policy decision-making. It includes a discussion on the common barriers to policy decision-making and highlight the need for change by providing an overview to the background of ‘hard’ Operational Research and ‘soft’ Operational Research in the context of decision making. It discusses methodological options and the concept of multimethodology. It discusses the identification of a multimethodological approach for use with the proposed framework and provides justification on its appropriateness for the support of policy decision making. This chapter concludes by introducing an alternative framework for policy design and analysis and details the steps to developing that framework and how and where the chosen methodological approaches are applied. It discusses how the chosen methodological approach can add richness to existing frameworks and how this evolves into a new framework. It is important to note that the word methodology has been used with the following definition:

“a set of methods and principles used to perform a particular activity” –

*Oxford English Dictionary*

## **Chapter 6 – Applying the Framework**

Having discussed and chosen the methodologies to support the development of a new framework for policy design and analysis, this chapter focuses on application of that framework using three case studies to guide thinking and test the validity of elements of the framework as it is applied to the three chosen case

This chapter discusses the benefits and limitation of case study research and introduces the case studies chosen to test elements of the proposed framework. These are:

- The Mid-Staffordshire investigation to establish the validity of the methodological choice in identifying causality using interview transcripts.
- Environment Agency Wales to test the multimethodological approach
- Child Protection as a suitable case study for the early stages of the methodological framework that seeks to establish the context and frame the problem to enable a thorough investigation into the problem space.

This chapter provides details on how policy decisions are usually made in the field of child protection and demonstrates why a new approach is needed to define appropriate policies. It shows where the new framework has been used to fully investigate the problem domain by identifying the core purpose, mapping causality to frame the problem and identify where policy action is required and develop a simulation environment to test potential policy actions.

## **Chapter 7 – Evaluation of Results and Conclusions**

This chapter identifies an independent means of evaluation to compare the developed framework against more traditional frameworks used in policy decision making. It focuses on the evaluation of applying the methodological framework in the domain chosen as a case study and where it differs from similar methodological approaches. It details how a thorough investigation

into the problem space can identify where policy action is needed and allow for simulation and experimentation to test potential policy actions.

## **Chapter 8 – Contribution and Future Work**

This chapter summarises the work presented and considers the future development of the work. It details the contribution made and details the achievement of the objectives required to prove the hypothesis.

## **Chapter 2 – Motivation and Scope**

### **2.1 – Introduction**

Both mainstream and social media is littered with examples of public policy failures within the UK Government. The book “The Blunders of our Governments” by Anthony King and Ivor Crewe published in 2013 details some of the most famous of the disastrous public policies implemented by the UK Government between 1980 and 2010. Each of the policies discussed in the book either completely failed to address the real problem, exacerbated the problem or caused completely new and bigger problems. Though some of these ‘blunders’ stemmed from a total disconnect from large sectors of the UK population by the ministers and high officials that represent their interests in parliament, some stemmed from a total lack of ministerial accountability or penalties for policy failure, while others from a desire to be seen as decisive (King & Crew, 2013). Whilst the book provides an eye-opening yet amusing look at some high-profile policy failures, there is an underlying seriousness with respect to the reasons behind the failures. It is the serious nature of public policy failures that provided the motivation for this thesis. This chapter discusses the motivation, the scope of the thesis and the thinking behind the proposed solution that this thesis presents.

### **2.2 – Understanding the Issues**

Whilst failure in everyday life can be difficult to accept, it is commonly something we learn from to enable us to better ourselves. However, failure in the world of public policy can have costly and damaging consequences (Derwort, 2015). Where we use personal failure to learn from our mistakes

and prevent future failures, failure in the public policy domain rarely follows the same pattern. There are plenty of cases to suggest that the same policy mistakes are repeatedly made, where lessons go unlearned and the focus becomes deflecting blame or burying the failure (Dewort, 2015).

While there are many reasons for failure, most commonly reported failed policies are those where the problem it was intended to solve were not addressed (Newig, 2007). Though the causes of a particular policy failure can be identified, allowing for the adaptation of a policy, it is far more difficult to tackle persistent policy failures, where the same type of mistakes are made time and again (Howlett et.al. 2015), when it is worth considering the commonality between the failures and addressing those. This shows that the bigger issue lies in the public policy decision-making process and its lack of focus on the problem space before identifying solutions.

Further research into the domain of public policy decision-making revealed that there appeared to be a step missing in existing frameworks. Nearly all the frameworks used for policy development and formation start with a Step 1 – “Define the problem”. This step assumes that a problem has been recognised and correctly identified but how *do* we know if we have a problem?

In 2014, HBO launched the latest in its wave of hard hitting dramas, “The Newsroom”. During the first episode a character taking part in a panel was posed the question “What makes America the greatest country in the world?” His answer; “it isn’t”. While the scene is designed with the purpose of creating great television, it contains a thought provoking speech with the

powerful line “the first step to solving a problem is recognising you have one.”

Increasingly western governments use quantitative economic and social information as policy triggers rather than to inform policy debate (Weaver, 1989). But how much faith can we have that these quantitative measurements are providing a realistic view of the underlying problem? Are we measuring the right things? What should we be measuring and how does it relate to the real issues? Do we understand the domain and its interactions between people with roles in it?

Williamson (1994) stated that “policy reforms emerge in response to a crisis” and public policy decision making in public services has seen its fair share of crises leading to major inquiries; from the Mid-Staffordshire Hospital crisis to the high-profile inquiries into the failures of child protective services leading to child deaths. While inquiries can provide valuable insight into the causes of the issues, they are only dealing with the case on an individual level and the resulting policy reform is unlikely to address the wider issues, as these are only broadly considered as part of the inquiry. This is because the resulting recommendations for policy reform use the causality links identified as part of the inquiry to form the basis of the reform.

This is highlighted in the field of child protective services where the death of Victoria Climbié in 2000, led to a massive policy reform in Child Services. However, despite the massive changes introduced, a further reform was triggered in 2008 following the death of Peter Connolly (baby P). In 2010, following the election of a new coalition government, Dr Eileen Munro, was

commissioned to produce a series of reports looking at Child Protection in the UK. The results of these reports, the final one was published in 2011, led to further reforms. However, the death of Daniel Pelka in 2012 suggests that the problem/s still exist. This raises the questions, could a full investigation into the problem space, rather than drawing on the conclusions and recommendations from a single case inquiry, lead to more successful policy reform? And, what would this look like? It also shows present approaches are not working effectively.

Public policy decision-making is extremely complex involving multiple organisations with multiple, and often conflicting, priorities and perspectives. This requires a decision-making process that can both cope with and communicate that extreme complexity. Would such a process help prevent persistent public policy failures?

## **2.3 – Developing a Deeper Understanding**

If the issues with public policy decision-making stem from poorly defined policy problems, then a focus on the early stages of the policy decision-making process will likely yield better solutions; as Albert Einstein once said, “If I were given one hour to save the planet, I would spend 59 minutes defining the problem and one minute resolving it.” While this may appear extreme, it does highlight the importance of defining problems. However, defining policy problems is difficult as first there is a need to recognise the existence of the problem and somehow try to name that problem and define the domain in which it occurs. In addition, the problem must then fit into a political context to begin to address it. Nelson (1984), gives examples of

how the problem must be identified and conceptualised before bringing it to the political arena. The work in agenda-setting by Cobb and Elder (1983), Baumgartner and Jones (1993) and Kingdon (1994) also present an argument that problems must be recognised, identified and labelled before they can be addressed by the political process. This suggests that labelling of the problem to ensure it reaches the political agenda will advantage some organisations, groups or individuals whilst others become the victim of the policy (Peters, 2012). This leads to conflict and the need to consider conflict resolution when framing the problem. Unlike the cyclical policy decision-making models, design of policy can result in identifying multiple causation which again add to the complexity of the public policy decision-making process (Linder and Peters, 1984). The complexity increases with competing models of causality from competing stakeholders. To address all these issues of complexity, methodologies that are capable of coping with this are required.

## **2.4 - Exploring Potential Solutions**

If the problem with policy problems is taken to be the lack of attention given to the early stages in the policy decision-making process - the problem definition - then it is proposed that the solution lies in a deeper focus on these earlier stages. This solution needs to provide the 'tools' to fully explore the problem situation, identify the real issues and thoroughly investigate them, whilst considering all the multiple causalities and the multiple stakeholders, views and priorities of those involved. These 'tools' are likely to be found in the fields of Policy Informatics and Systems Thinking, which bring together models of causality and consider multiple perspectives. The



focus on finding the right 'tools' for problem investigation and definition means identifying appropriate methodologies that can be used in their entirety, in part, or through mixing multiple methodologies. This is traditionally considered to be Problem Structuring Methodologies (PSMs). There is a comprehensive discussion of PSMs in Chapter 5 section 5.4.4.

The methodologies chosen as a result of in-depth research into PSMs were Soft Systems Methodology (SSM) and System Dynamics (SD). Both these methodologies allow the problem situation to be considered from multiple perspectives (Wilson, 2001), (Forester, 1980). Although both are considered to be Systems Thinking methodologies and as such have common features of Systems Thinking, they have distinct differences in their approach and focus. Both allow a problem situation to be conceptually viewed as a system to enable investigation into that problem situation. However, their investigations differ; SSM offers a view of the problem situation from multiple perspectives as it seeks to identify the 'core purpose' of the system, whereas SD offers a view from multiple perspectives as it seeks to identify the 'causality' that exists within the system. Although each of them enables a detailed investigation into the problem situation, it is the combination of the two that allows a much more comprehensive investigation.

## **2.5 – Deriving the Scope**

After identifying the methodologies to be used; these then needed to be tested against suitable case studies that could be considered policy problems. Three case studies were used to shape and guide the thinking, determine the scope and test the robustness of the methodological choice.

Detailed discussion of these case studies can be found in Chapter 6. Each brought something different to the table, but it was the application of the methodologies in each of the case studies that enabled a resulting framework to develop as an emergent property of the applications. The following case studies were chosen:

1. Mid-Staffordshire Inquiry chosen to test the ability of SD to frame a problem situation using interview transcripts to map causality
2. Environment Agency Wales chosen to test the ability of SSM to represent the multiple perspectives in a single conceptual model of the system and identify the core purpose, critical dependencies and appropriate measures of performance in a 'green-field' situation
3. Child Protection Services used to combine the methodologies to identify the core purpose, critical dependencies and appropriate measures of performance, and, map the causality of the system

The first case study focussed solely on the use of SD and used transcript evidence to identify and map causal relationships. This ability to map causality from inquiry evidence is key in the field of policy decision-making as public policy problems are commonly identified in response to an event which results in a public inquiry or reviews. However, when using inquiry evidence or interviews, difficulties can arise in mapping the causality as seen through the eyes of the interviewee or interviewer. Care needs to be taken to ensure that assumptions are identified and questioned resulting in an iterative model building process.

The second case study initially focused solely on applying SSM to identify the core purpose, critical dependencies and measures of performance that would be required in a devolved Environment Agency for Wales. Using Brian Wilson's (2001) approach to SSM which includes Enterprise Modelling, multiple perspectives could be considered and included in a large conceptual model of the system. The conceptual model is then used as a frame of reference to compare the 'real-world'. Because core activities and critical dependencies are identified, which are logically derived from an agreed set of Root Definitions, this provides evidence to support organisational change when compared to the 'real-world', 'as-is' situation. In this case study, the organisation wanted to see what this organisation change could look like and how this would impact on their policy choices. This led to the development of SD maps of causality based on the information derived from the SSM conceptual modelling. Although both SSM and SD were used in this case study, they weren't truly combined, but it provided the inspiration to mix the methodologies as a cohesive process.

The third and largest of these case studies enabled the testing of the mixed methodological approach and identified where this new approach could be developed into a framework for policy design and analysis that focussed purely on problem identification and investigation. Research into the area of Child Protection identified Professor Eileen Munro as a key player in this field with over fifty publications on the subject of child protection. Her later works introduce Systems Thinking as an alternative approach to investigating the issues surrounding child protection. Her review of child protective services published in 2011 detailed a systemic approach and used SD as a

methodology to investigate the issues. This presented a unique opportunity to test models produced by applying the methodological choice detailed in this thesis using a direct comparison with Munro's models. The evaluation of this direct comparison can be found in Chapter 7 where models are also evaluated using ideas expressed by Checkland (1995) and Forester (1961, 1980). This direct comparison evaluation yielded useful and valuable results and demonstrated where the use of combined methodologies, within a defined framework, provided a more comprehensive investigation and, identified information needs not identified by Munro's investigation. The use of both SSM and SD also helped provide the necessary linkage of models to fully understand the behaviour of the system and identify where changes to one part of the system impacted on another part of the system. The framework itself was also evaluated using Brook's (1986) ideas of a 'Silver Bullet'. Using the key concepts of 'complexity', 'conformity', 'changeability' and 'visibility' the proposed framework was compared and contrasted to the more traditional cyclical frameworks used in public policy decision-making such as the ROAMEF (Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback) model and the Rationalist Model.

## **2.6 – Conclusion**

This chapter has been used to provide an overview of the motivation for the research contained in this thesis and the scope of the work. It also provided an introduction to the ideas that developed understanding and shaped the thinking.

It has highlighted the focus of the research as being to seek to find a suitable mechanism for addressing the issues with problem identification and investigation found in traditional models of public policy decision-making. In narrowing the focus and determining the scope, the following hypothesis has been developed:

*It is possible to create a methodological framework for policy design and analysis that provides a clear process for policy problem identification, definition and investigation that addresses common issues which arise when using traditional cyclical policy frameworks*

The thesis will delve into the field of policy science, Policy Informatics and Systems Thinking as it discovers the 'state of the art', identifies potential solutions to issues with the 'state of the art' and applies the developed framework as a potential solution to them.

The framework developed and described in this thesis is intended for use in public policy problem identification and investigation and it can be used as an independent framework for policy design and analysis or can be used in conjunction with the traditional cyclical models by providing a 'how' to the early stages in the model such as 'problem definition', 'agenda setting', 'policy formulation' and 'evaluation'. The framework does not go as far as 'policy implementation' but it can identify alternative policy actions and test the alternatives using 'what-if' analysis on simulation models. It can also use those same simulation models to provide and test a policy implementation plan to understand the impact that implementation would have on the system (including the people and organisation involved with the system). However,

it is important to note that the work contained in this thesis does not include implementation planning which could be the basis of future work.

## **Chapter 3 – The Subject of Public Policy and Policy Decision Making**

### **3.1 – Introduction**

Public Policy is policy that is created by Government for public benefit. That is, an action plan, to enable the Government to achieve specific goals. The policy itself is the broad action plan devised in response to a perceived problem, formulated by a specific political process and implemented and enforced by a public agency. It is usually realised through a series of programmes to deliver the actions detailed within the policy (Miljan 2012).

Since Laswell's introduction of the policy process model in the 1950s, the sequence of distinct stages of the policy cycle has become the 'norm' for formulating and supporting policy decision making (Fischer et al. 2007). This chapter defines what is meant by 'Public Policy', explores the theory of public policy, the types of public policy and the policy process as a cyclical model. Focussing on adaptations of Laswell's original seven stage model, such as Anderson's model and the ROAMEF framework (Hallsworth & Rutter 2011), the stages of the cyclical model are discussed in terms of their strengths and weaknesses.

Public policy problems are intrinsically complex and are usually inherently multi-disciplinary. This means techniques that support multiple perspectives, involve multiple stakeholders and require multiple sources of information, are essential for the investigation, analysis and support of policy decision making (C. Barrett et al. 2011). Public policy decisions are not only multi-disciplinary but the approach to them is also multi-disciplinary.

In developing an alternative framework for use in public policy decision making, it is important to explore the theoretical background to public policy decision-making and the typologies of public policy decision-making processes. This thesis explores different public policy theories; Multiple Stream Analysis (section 3.2.1), Social Construction and Policy Design (section 3.2.2), Narrative Policy Framework (section 3.2.3), and Institutional Analysis and Development Framework (section 3.2.4) (Fischer et al. 2007). Discussion also includes the most common typologies of public policy process; the Incremental Model (section 3.3.1), the Cyclical Model, based on the Rationalist Model of decision making (section 3.3.2), the Mixed Scanning Model (section 3.3.3) and the Systems Model (section 3.3.4).

### **3.2 – The Theories of Public Policy**

Policy theories contain a diverse range of concepts, frameworks and focuses of interest, with some paying more attention to the policy making process than others. Though diverse in their nature, they form the grounding for the policy decision making process, whether their focus is on understanding many cases, or the in-depth understanding of a single case. To fully understand the policy making process, an understanding of the theoretical grounding behind it is needed. However, it is important to note that in recent years the development of policy process theories was born from a dissatisfaction of scholars and researchers of the ‘stages’ frameworks most commonly used in public policy decision making (Nowlin, 2011). This supports an argument for the development of an alternative framework for public policy decision-making.



### **3.2.1 – Multiple Stream Analysis (MSA)**

Developed by John Kingdon, Multiple Stream Analysis (MSA) uses the idea of three distinct 'streams' to describe the gap between a policymaker's attention to a problem and their adoption of a meaningful solution. The foundation of his theory is in the non-linear relationship between the attention given to a problem, the range of solutions possible and the choice of the best possible solution (Kingdon, 1995). He theorises that as attention is given to a problem, the alternative solutions are also produced. In other words, as a problem is focussed on, so the alternative solutions to that problem emerge as the policymaker's attention lurches from one problem to another (Baumgartner 2006). He suggests that the three 'streams'; problem stream, politics stream and policy stream, should come together simultaneously through what he refers to as 'a window of opportunity'. The problem stream focusses on problem identification and addresses issues involving policy makers and stakeholders. The policy stream focusses on the solution alternatives, bringing together the ideas of those involved in the policy making process. The politics stream focusses on the national political landscape considering public opinion and policymaking institutes (Zahariadis 2008) and involves those who have the power to implement a policy. MSA theorises that policy change happens when a 'window' of opportunity occurs aligning the three streams. In other words, when an identified problem and suitable solution is acceptable within a current political landscape (Cairney & Jones 2016). As such, it is possible for policy experts and advocacy groups to apply already existing solutions to a problem as it is identified. Such practices are known as "problem surfing" (Boscarino 2009) where advocacy

groups change their message depending on the problem identified within a particular political context.

One of the major limitations of MSA is its assumption that the streams are independent of each other (Robinson & Eller 2010). However, as Kingdom suggests, as a problem is identified, potential solutions are already being formed which means that those involved in the problem identification are also heavily involved in developing policy solutions (Robinson & Eller 2010). This suggests that the merging of the streams under a 'window of opportunity' does not necessarily happen but could also suggest that the area of policy decision making is far more complex than MSA theorises. It could also support the criticism that MSA does not produce testable hypotheses.

### **3.2.2 – Social Construction and Policy Design (SCF)**

Initially developed by Scheider and Ingram (1993) the social construction and policy design framework looks specifically at how the population targeted by a policy can influence the type of policy created. It also looks at how a policy action can change the way in which the target population are perceived. The understanding of social constructs within policy decision making means that policy can be designed to fit a specific political rhetoric or, can be designed to address issues related to public political participation (Schneider & Sidney, 2009).

Key to the Social Construction and policy design Framework (SCF) is the data collection and analysis that is required to ascertain the impact of a policy action. This considers critiques of the more traditional policy decision making frameworks, such as Rational Choice, or ROAMEF, which argue that

policy should be 'designed' (Hallsworth, 2011). Schneider & Sydney (2009) identify nine elements of policy design:

1. Problem definition and goals
2. Benefits and burdens to be distributed
3. Target population
4. Rules
5. Tools
6. Implementation structures
7. Social constructions
8. Rationales
9. Underlying casual assumptions

Imgram et. al. (2007) suggest that policy design should be included in the policy making process as both an independent and dependent variable, whereas James & Jorgensen (2009) argue that policy design should be included only as a dependent variable. James and Jorgensen (2009) suggest that future work in the theory of social construct and policy design needs to study the impact of policy information in shaping policy design. Whilst this is something that does merit further attention, it also negates the argument that policy design is only a dependent variable. As an independent variable, policy design can act as a mechanism for a feed-forward process (Schneider & Sydney, 2009). This is evident when policy is designed to impact the way in which the policy's target population is viewed. In other words, when policy is designed to change the social construct of a population to fit with a political rhetoric.

### **3.2.3 – Narrative Policy Framework (NPF)**

The Narrative Policy Framework (NPF) is an emerging trend that looks at how policy related information and political context is processed by the individuals involved in the policy making process (True et al. 2006). NPF assumes that individuals understand the policy issues as contextual “stories” that have a plot, characters and a moral to the story (Jones & McBeth 2010). These narratives can be generalised to fit normative beliefs or relative to a particular social construct. (Jones & McBeth 2010) identify four ways in which it is possible to use narratives to shift public opinion:

1. Narratives that change how an individual views the world
2. Narratives that allow the individual to relate to the ‘hero’ in the story
3. Narratives that are consistent with the individual’s prior beliefs
4. Narratives that are from a source trusted by the individual

These different types of narratives are strategically used depending on the users’ political agenda and the context of the political debate. NPF is particularly useful at providing policy scholars with a means to understand what information is relevant and how this information is used, disseminated and interpreted by both the policy decision makers and the public at large (Nowlin 2011). NPF also enables the understanding of why and how information is processed and weighted by governments who are using it to inform policy decision making.

### **3.2.4 – Institutional Analysis and Development Framework (IAD)**

The Institutional Analysis and Development (IAD) Framework was developed from Institutional Rational Choice (IRC) and examines the role of institutional

activities on human behaviour (Kiser & Ostrom 1982). Institutions within IAD are defined as “shared concepts used by humans in repetitive situations organised by rules, norms, and strategies” (Ostrom, 2007). IAD assumes that human beings within an institutional group are self-governing and introduce their own rules depending on the type of group they belong to (Hardy & Koontz 2009). These rules then influence the impact on policy outcomes when a policy is implemented. IAD is the only policy theory that focusses on institutions but a major criticism is its lack of attention to multiple institutions working collaboratively (Lubell et al. 2010).

### **3.2.5 – Summary of Theories of Public Policy**

The recognition by John Kingdon of a non-linear relationship between policy problems, solutions and politics is instrumental in the theory of MSA and its inclusion in this thesis. Whilst MSA holds the idea of a ‘problem’ stream it has insufficient focus on problem investigation and instead assumes that as problems are identified, suitable alternative solutions are also identified. Key to the theory of MSA is the concept of a ‘window of opportunity’ where policy action occurs. This indicates that policies are neither designed nor is there a structured policy decision-making process. However, the theoretical concepts of MSA can be applied to the traditional cyclical models where the assumption exists of a problem that is easily defined and where a range of alternative solutions are also easily defined.

In contrast to MSA, SCF suggests that policies should be designed.

However, the concept of design within SCF is with a focus of fitting a political rhetoric with a view to changing public opinion or with a focus on addressing

issues identified through public participation. Like MSA, SCF assumes a problem is easily defined. The nine elements of policy design identified by Schneider & Sydney (2009) include 'problem definition and goals' but do not include problem investigation. Its core concepts of social construction indicate a focus on problems as they are perceived to be, rather than considering what they *actually* are.

Most useful in the theory of SCF is its focus on data collection and analysis for public policy decision-making. This is key to its inclusion in this thesis due to its fit within the field of Policy Informatics, which requires addressing the data and information identified, used and generated as part of the policy decision-making process.

Similar to SCF, NPF focusses on the concepts of social constructs in the design of policies to shift public opinion. It identifies four narratives that are used depending on the political agenda of the user or the context of the political debate. Like SCF this theory views problems as clearly definable and identified by the political rhetoric. This means that problems are not fully investigated for what they are but rather defined by what the policy decision maker assumes them to be.

Like SCF, the inclusion of NPF here is largely due to its focus on information used, disseminated and interpreted during the policy decision-making process. This focus which enables the understanding of how and why information is used to inform policy decision-making is also a key feature of Policy Informatics.

The discussion of IAD within this thesis, though brief, has been included because of its focus on human behaviour and the idea that human behaviour can shape the outcomes of a policy action once it has been implemented. This leads to the idea of emergence and unintended consequences where human action in response to an implemented policy action can either exacerbate the problem being addressed or create new problems.

The following table provides a summary of the key concepts, assumptions, limitations and advantages of the public policy theories discussed.

*Table 1: Summary of Public Policy Theories*

	MSA	SCF	NPF	IAD
Scope	Ambiguity in policy decisions focussing on policy decision makers	Dynamism in policy decisions focussing on populations	Public opinion and influence in policy decisions	Policy decisions as an outcome of institutions
Key Concepts	3 'streams' aligning as a 'window of opportunity' to enable policy change	Policy design influenced by social constructs and population groups targeted by policy design	Use of narratives to influence public opinion to fit a political rhetoric	Institutions as self-governing leading to collective action
Assumptions	Streams are independent of each other	Problems are clearly defined and/or fit within a political rhetoric	Problems are clearly defined and/or fit within a political rhetoric	Institutions are self-governing and produce their own set of rules
Limitations	Lack of testable hypotheses, insufficient focus on problem investigation	Policies designed to fit a political rhetoric rather than solve a genuine policy problem	Policies designed to fit a political rhetoric rather than solve a genuine	Views institutions as singular entities and doesn't consider multiple institutions

			policy problem	working collaboratively
Advantages	Identifies a non-linear relationship between policy problems, solutions and political rhetoric	Focus on data collection and analysis as well as a focus on policy design	A focus on information, what is relevant, how it is used and how it is disseminated	A focus on human behaviour and how it can shape the outcomes of a policy action once it has been implemented

### 3.3 – Policy Models

Models of public policy are used to represent the complexity that is the public policy decision-making process with some being more structured than others (Benoit 2013). This section looks at four models for public policy decision-making with a focus on the cyclical model and its iterations.

#### 3.3.1 – The Incremental Model (IM)

Based on the concept of incremental decision making, the incremental model describes the introduction of new policies that differ only slightly from existing policies. It is commonly referred to as ‘muddling through’ as, if an incremental adjustment is unsuccessful the situation is reverted to the previous policy and if it is successful the policy continues in its new format (Lindblom, 1959).

The issues with this approach are that policies are not ‘designed’ and changes made using this model tend to be reactive. The incremental model is largely criticised for its lack of innovation and the random nature in which policy change is made using it (Padgett, 1980). It also fails to consider the complexity associated with policy decision making (Jones & Baumgartner,

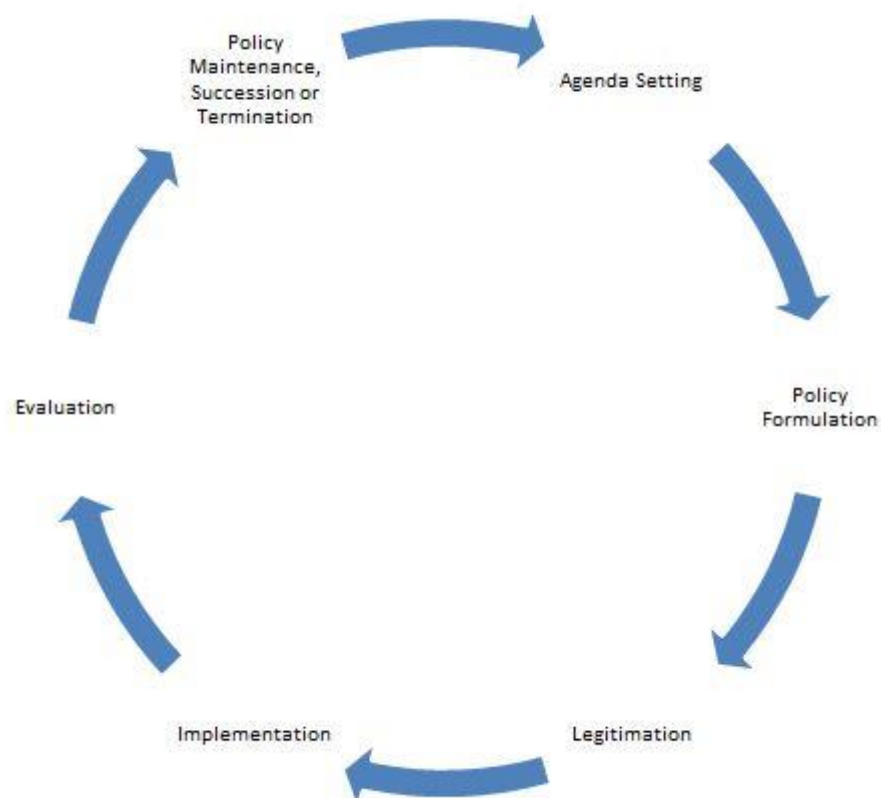


2005). However, among its advantages are the ease with which failed increments can be reversed, and that the costs associated with small incremental changes are far less than those associated with large sweeping changes (Jones & Baumgartner, 2005). Having said that, the size of policy change is purely subjective; what appears as a small change for one person, will appear as a large change to another. The fact that there appears to be no agreed standard for what size of change can be considered as non-incremental, means that the incremental model can be applied in inappropriate situations, i.e. where the policy action leads to significant societal changes (Padgett 1980). In making policy change using the incremental model, the question should be asked whether the change is to achieve either policy re-design or policy stability (Padgett 1980).

### **3.3.2 – The Cyclical Models**

In 1956 Lasswell proposed a seven-stage model of the decision-making process; *intelligence, recommendation, prescription, invocation, application, appraisal and termination* (Parsons 2002). In the intervening years, the model has evolved with versions developed by (Anderson 1975), (Wildavsky 1978), (Jenkins 1978) and (Brewer & DeLeon 1983) being among the most common variants. The decision-making model still forms the basis for policy decision making, with *agenda-setting, policy formulation, decision making, implementation and evaluation*, being the conventional means of describing this linear policy process based on Lasswell's original cyclical framework (Jann & Wegrich 2006). This is usually followed by either *policy maintenance, renewal or terminations* (see figure 1).

Whilst it has been noted that real world decision making does not usually follow these discrete stages (Hallsworth & Rutter, 2011), the model remains the 'ideal-type' for rational planning and decision making as it prescribes that decisions "should be based on a comprehensive analysis of problems and goals" (Jann & Wegrich, 2006).



*Figure 1: Policy Cycle based on the 'Rationalist Model'*

The stages of the policy process follow a logical, linear order, in that problems are identified, policies are developed, considered, and the most appropriate selected for implementation (Lasswell, 1956). Policies are then evaluated to ascertain their effectiveness and efficiency to decide whether they should be terminated, adapted or replaced (Hanberger 2001). The

continuous nature of public policy, and the frequency with which a new policy evolves after implementation, has seen these stages develop into a cyclical model that draws attention to the feed-back between the policy outputs and inputs. A policy output will impact the wider environment leading to inputs for future policies. Policy action can also result in unintended consequences which will create the need for policies to be either replaced or modified: or a new policy initiated (Hogwood & Peters 1983). This continuation of the policy process where policy decisions are made in an ever-evolving political landscape means that new policy decisions tend to focus on changing, or evolving existing policies, either completing or complementing old policies. This leaves little room for innovative policy decision making where there is an existing policy (Hogwood & Peters 1983).

#### **3.3.2.1 – The Rationalist Model (Jones & Baumgartner 2005)**

The Rationalist Decision-Making Model (see figure 1) is a type of decision making model that describes and utilises the discrete steps in the process of decision making. There are varying types of rationalist model with a varying number of steps, but each have the same principles outlined by Lasswell's theorising of the policy making process (Anderson 2003). Each example of a rationalist model tends to start and end with the same stages; problem formation and evaluation leading to termination or adaptation, with a variety of intermediate steps (Jann & Wegrich 2006). However, despite its wide adoption in the policy making field, the rationalist model makes several assumptions which contribute to its limitations. Among these assumptions are 1) that the decision making is rational and 2) that the situation the decision making occurs in is unambiguous (Hanberger 2001). However,

public policy is usually ambiguous with multiple stakeholders and viewpoints, and, it is also irrational (Jones & McBeth 2010).

#### **3.3.2.2 – The ROAMEF Framework (Hallsworth & Rutter 2011)**

Focussing on the generic features of public policy making, the cyclical framework is the most widely adopted in policy research and policy decision making (Hallsworth & Rutter 2011). In UK Government, the ROAMEF (Rationale, Objectives, Appraisal, Monitoring, Evaluation, Feedback) model, shown in figure 2, forms the basis for policy making in most Government departments. ROAMEF is criticised as being outdated and unrealistic (Hallsworth 2011a) with critics of the ROAMEF cycle also arguing that a greater focus needs to be on policy design. This is so that a chosen policy action represents a viable and realistic approach to achieving the policy goals (Hallsworth 2011a), (HM Government 2013).

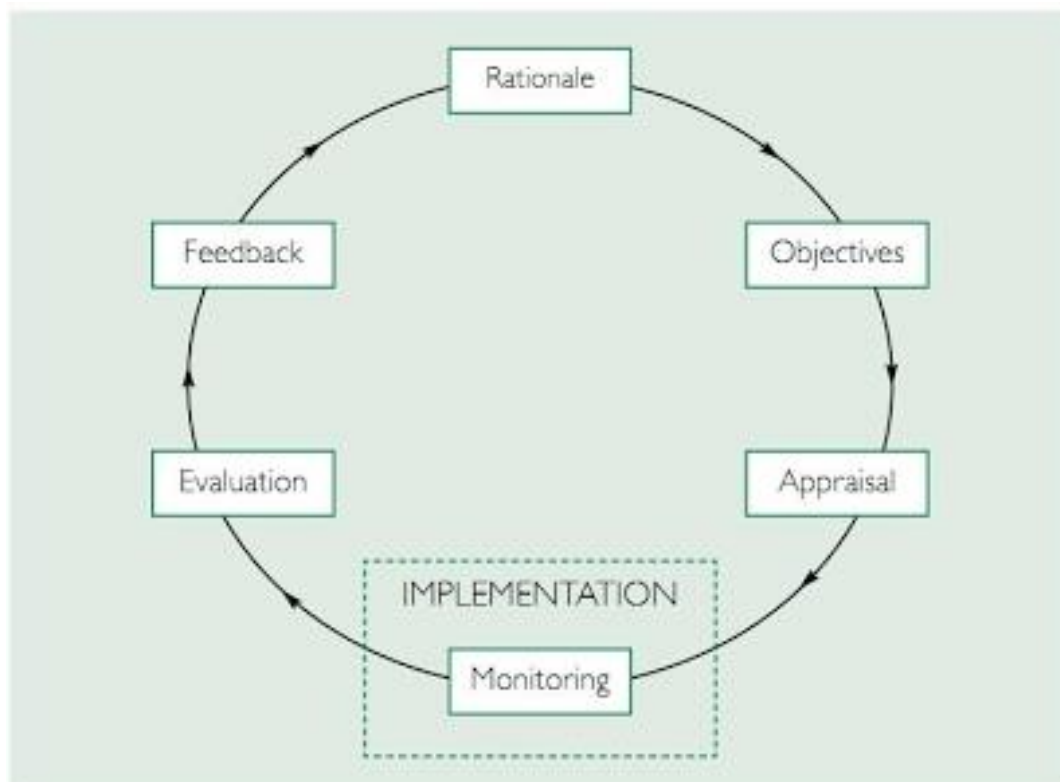


Figure 2: The ROAMEF Cycle from (Hallsworth 2011b)

The ROAMEF Cycle, laid out in the UK Government's 'Green Book' (HM Treasury & Treasury 2003), is a six-step framework for the planning and implementation of public policy. The stages of the ROAMEF Cycle are:

**Rationale** – This is where the need for the policy is identified and evidence provided to support the need for policy action.

**Objectives / Appraisal** – Evidence is used to identify the options available and determine the most appropriate response to a policy problem.

**Monitoring** – checking the progress of the policy action during its implementation.

**Evaluation** – checking the impact the policy action has had.

Feedback – using results from the monitoring and evaluation steps to identify what works and if and where improvements are needed.

### **3.3.3 – Mixed Scanning Model**

The Mixed Scanning Model (MSM) is a combination of the Rationalist Model and the Incremental Model where the characteristics of both models are integrated to review an existing policy with a view to focussing on a specific need (Hanekom, 1987). Developed by Etzioni in the late 1960s, the aim behind the theorisation of MSM was to address the disadvantages found in the Rationalist Model and the Incremental Model. The Rationalist Model with its wide view of the problem situation, its alternative solutions, and the information rich necessity of the problem formulation stage, means that policy decision making using this model can be both time-consuming and costly. In contrast, the small changes focus of the Incremental Model allows a less focused requirement for identification of alternative solutions and supports a ‘trial and error’ approach. This is because the Incremental Model enables the reversal of an incremental change with little impact, which means issues where policy makers are potentially dissuaded from halting or reversing that action, due to commitment or investment are also addressed.

The concepts behind MSM can initially appear complex but, MSM explores the idea of an overarching goal with decisions required toward achieving that goal being made in incremental stages (Etzioni, 1967). While this can appear advantageous, the narrowed attention to one decision at a time can cause focus on the wider issue to be lost, especially if the incremental changes take the policy further away from its intended goal. This can

happen when commitment to the Increment Model means making comparisons to the previous position rather than to the eventual intended outcome.

One of the biggest issues regarding MSM is the lack of case studies to prove the effectiveness of the technique. Also, the difficulty in establishing a quantifiable evaluation of policy decisions made using this model, makes it difficult to ascertain how far away the eventual outcome is from the original goal (Etzioni, 1987).

### **3.3.4 – The Systems Model**

Using ideas, such as input, output and feedback that stem from Information theories, the Systems Model for public policy focuses on the policy decision being made in the context of its wider environment. There is no specific method or technique for a systems theory approach in the context of policy decision making, but rather it is a conceptual way to think about a problem (Quade, 1969). In using systems theory approaches, three main areas of inquiry are required. Firstly, the problem situation needs to be holistically explored. The exploration of the problem situation should include identification of the people and organisations involved, and identification of appropriate measures of performance that will be used as criteria to evaluate alternative solutions. Next the alternative solutions should be clearly identified, or designed if necessary, and assessed for feasibility, cost and risk. Finally, the predicted outcomes should be compared with the original objectives identified through problem exploration (Quade, 1969).

It is important to note that the exploration of the problem domain should view the problem situation as it *actually* is, rather than what it appears to be. It is also important to note that these three stages of inquiry are an iterative process and that if the predicted outcomes don't achieve the intended objectives, new alternatives need to be identified or designed and the steps repeated (Quade, 1969).

The Systems Model was originally used in aerospace and other industrial areas of policy rather than the public domain and relied heavily on quantitative modelling and mathematical equations to help predict outcomes (Stewart & Ayres, 2001). However, as this approach has evolved it has included more qualitative methods in the exploration of the problem situation, when mapping causality to determine the full scope of the problem. The ability of a systems approach to not only view the problem situation 'as is' but also holistically, means that it is much more capable of coping with the increasing complexity that policy problems present in modern societies (Forrester, 1993). With a more informed society wanting a participatory public policy, the risks of unintended consequences and the diverse nature of organisations involved in the process, there exists additional levels of complexity that a systems theory inquiry can better address (Ghaffarzadegan et al. 2015).

#### **3.3.4.1 – System Characteristics**

The key concepts of a system (see figure 3) are centred round the characteristics that are present in the general concept of all systems. Key ideas are inputs, outputs, structure, boundary, environment and feedback. They also include the interaction between elements in the form of



relationships that can influence the system from within (Coyle, 1996). Key concepts include:

- Systems consist of interrelated and interconnected components where relationships exist between the parts and with the whole.
- The systems concept is hierarchical and can be conceptualised as comprising of many subsystems, each displaying systemic characteristics but connected to form a whole which becomes more than merely a sum of its parts.
- Systems have a boundary, but these are a means of placing limits on the system so that understanding can be gained and are, in themselves, artificial and as such flexible and open to interpretation.
- Systems are thought of in terms of open or closed, open meaning that they are influenced by their environment and closed meaning they are not. For the purpose of this work and considering the involvement of human activity, systems will be considered only as 'open' and as such can both influence and be influenced by their environment; that is, everything outside the 'system boundary'.
- Systems are designed to have inputs, outputs, and processes that turn inputs into outputs to produce the intended purpose. Processes within a system can form feedback loops. Feedback also takes place between the system's outputs, and inputs from the environment; such feedback is usually characterised by delay.
- As systems are a concept, they can reflect a diverse range of viewpoints (Weltanschauungen) based on the experience and knowledge of the systems thinker, and the various 'system'

stakeholders. This also allows the viewpoints of those within the system to be considered when defining the structure of the system.

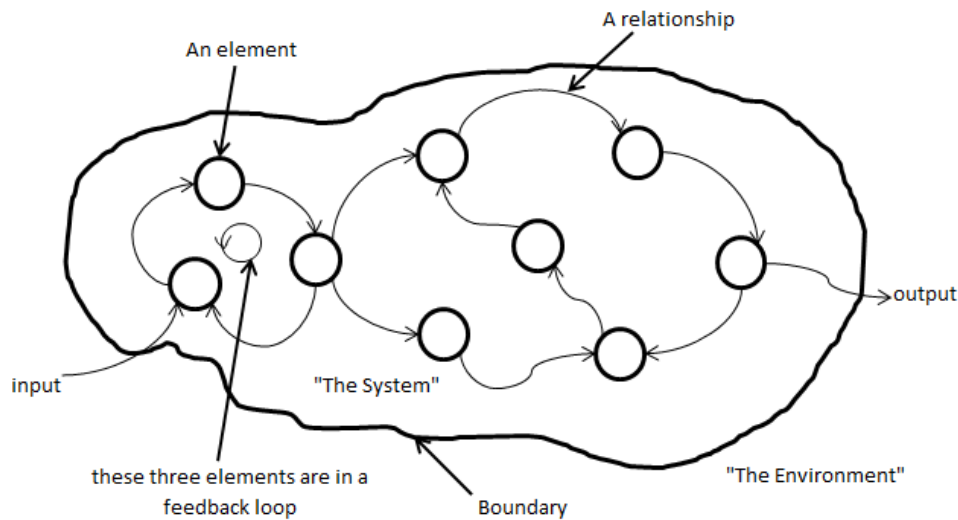


Figure 3: A general conception of a "system"

### 3.3.5 – Summary of Policy Models

As one of the more unstructured models, the Incremental Model, has the flexibility not present in other policy models. This flexibility enables the reversal of incremental changes with relative ease. Whilst the model is criticised for failing to consider the complexity of public policy decision making, its 'trial and error' approach fits with the framework for policy design and analysis described in this thesis. This is because it suggests a simulated environment for testing policy actions which uses a similar 'trial and error' approach.

The cyclical models, such as Rationalist Model and ROAMEF, are a focus for this thesis as they are the most commonly used within public policy decision-

making (Jones & Baumgartner 2005) due to their structured approach and distinct stages detailing the policy decision-making process (Benoit 2013). They have become the 'norm' for public policy decision making (Hallsworth & Rutter 2011) but are frequently criticised for being outdated and unrealistic as real-world policy decision-making rarely follows these discreet stages (Jann & Wegrich 2006). Critics such as Hogwood & Peters (1983) also state that this structured linear approach leaves little room for innovative policy decision-making.

MSM, as a combination of both the Incremental Model and the Rationalist Model is used to focus on a specific need within reviews of existing policies (Hanekom 1987). The aim of MSM was to address the issues found in the Rationalist Model and the Incremental Model (Etzioni 1967) and it explores the idea of each policy decision being part of a larger overarching goal (Etzioni 1967). Though this may appear a more realistic view of public policy decision-making, there exists a danger of losing sight of the larger goal when the focus is on one decision at a time. However, the idea that small incremental changes can be made in an environment using the application of the Rationalist Model leads to a wide view of a policy problem situation has its appeal.

The Systems Model addresses one of the main issues related to MSM in that it focuses on policy decisions being made in the context of their wider environment. The systems theory approach to policy decision-making is at the core of Policy Informatics and the holistic exploration of the policy problem situation is at the core of the new framework proposed and developed as part of this research. However, one of the criticisms of the

Systems Model is that there is no specific method or technique identified as an approach in the context of policy decision-making. The proposed framework should offer a clear methodological approach in the use of Soft Systems Methodology and System Dynamics.

### **3.4 – The Stages of the Policy Cyclical Model**

All examples of the Rationalist Model have similar stages to those first proposed by Lasswell (1956) and those shown in figure 1. Though some may have more stages than others and different terminology to identify the stages, the descriptions for the core five stages are the same (Benoit 2013). The following section identifies and provides an explanation of the five core stages of the cyclical policy models based on the Rationalist Model.

#### **3.4.1 – Agenda Setting**

The first stage of the policy cyclical model is referred to as 'Agenda Setting' but it is also referred to as 'Problem Definition', or, as in the ROAMEF model, 'Rationale'. The term 'Agenda Setting' assumes the correct identification of a problem that requires some type of intervention. It also assumes the recognised problem has been added to an agenda for action. In real terms the agenda is a list of issues that are to be given serious consideration by government officials, or those closely linked with government officials (Kingdom 1995). In this context, the agenda will be considered separately from the wider public (or media) agenda. This differentiation is known as either institutional (government) agenda or systemic (public) agenda (Cobb & Elder 1972). Though the agenda-setting stage of the public policy cycle

largely represents a government's formal agenda, it is coupled to the way in which a social problem is recognised by the wider society (Birkland 2004).

Since the 1960s studies into the policy process have shown that agenda-setting and problem recognition are inherently linked as part of the political process but commonly attention is given to a recognised problem based on the political agenda of the time (Hanberger 2001). The connection between problem recognition and agenda-setting is therefore, not necessarily linear as political actors will seek to shape a political agenda by dramatizing an issue or taking advantage of rising public awareness or media attention given to an issue. Political actors will also strategically use media coverage of an issue to gain political momentum in defining issues to be included on the agenda (Baumgartner & Jones, 1993). As agenda-setting is largely a process of structuring the policy issue by selecting which problems to focus on it must be accepted that not all problems will receive attention, which raises the question of non-action for a problem as a political decision to deliberately exclude an issue from the formal agenda (Bachrach & Baratz, 1962), (Crenson, 1973), (Cobb, Ross & Ross, 1976).

This key stage in the policy process focuses on moving a problem from its recognition to its inclusion on the formal political agenda. This implies that several 'sub-stages' are needed to first recognise that there is a problem and then to ensure the problem is clearly defined (Jann & Wegrich 2006).

Although it is accepted that problem recognition and definition can be steered in the public arena by media or interest groups, the formal agenda-

setting is broken down into four pattern types based on the role of the public and their involvement in the process (Howlett & Ramash 2003). These are:

- *Outside-initiation*: where government is forced to add an issue to the political agenda as social actors seek to gain public support.
- *Inside-initiation*: agenda-setting where interest groups with direct links to governments or government agencies apply pressure to have an issue included on the agenda without the need for public acknowledgement.
- *Mobilisation*: where the government will seek to gain public support after the initial agenda-setting has been completed.
- *Consolidation*: where political figures initiate action for an issue where high public support already exists.

Although these four types of agenda-setting exist, the role the public and media play in most modern societies is distinct in policy-making and agenda-setting. This is particularly true in cases where problems identified as risks emerge (Hood, Rothstein & Baldwin, 2001). Such reactive policy changes are often short-lived or will be significantly adapted as the public attention shifts to a new issue (Lodge & Hood, 2002). Whilst the agenda-setting stage in earlier models of the policy process were linked to mostly economic or social changes, modern societies and the rise of public participation in the policy making process has seen a rise in the number of variables that determine whether an issue is included on the political agenda (Haas 1992). This change in the political landscape of modern societies implies that agenda-setting is far from rational, as rising attention by the public and media

of an issue can lead to contrasting policy actions. In other words, governments end up adopting a policy that directly conflicts with an earlier policy or results in the removal of an issue from the political agenda altogether (Jones 2001).

### **3.4.2 – Policy Formulation**

In this stage of the policy process, problems, issues and proposals are formed into government programmes. This includes the identification of objectives that will lead to the achievement of a solution (Anderson 2003). It is at this stage that consideration is given to alternative actions to address a policy issue (Benoit et al. 2013). Research on this stage of the policy process tends to be theory heavy due to the diverse range of patterns, styles and methodologies adopted to identify the criteria used to support decision making as the link between the policy process and organisational decision-making theories has evolved (Olsen, 1991). Theories of public policy provide the grounding for how the policy is formed yet work in this area also attempts to improve government practices through the introduction of tools and techniques to support rational decision making. Political scientists have long argued that decision making should include conflict resolution along with information gathering and analysis (Lindblom, 1968), (Wildavsky, 1979). However, participation by different departments involved in the policy process is usually sequential and occurs after the initial policy programme has been devised. This results in negative coordination and impedes conflict resolution, whereas conflict resolution is achieved through positive coordination (Mayntz & Scharpf, 1975). Positive coordination occurs when

government departments' work together to identify policy solutions as part of the process to develop the policy programme.

Though the final policy decision is the responsibility of the formal institutions of government, the decision is preceded by less formal negotiations with different government departments, government ministers and organised interest groups (Hanberger 2001). Whilst earlier studies into the policy making process determined the role of institutional bureaucracy and top-level government officials as crucial to the policy formulation stage (Dogan, 1975), (Heclo & Wildavsky, 1974), governments and high level civil servants are no longer separated from wider society. Like most of the other stages in the policy process, policy formulation can also be considered as being made up of sub-stages (Hanberger 2001). As such the initial sub-stages of decision making and the participatory processes involved are more influential on the outcomes, than the final sub-stages of government processes and the parliamentary arena which shape these latter sub-stages (Kenis & Schneider, 1991). As with the agenda-setting stage, the evolution of societal involvement in the policy making process sees the policy formulation stage move away from rational decision making, where objectives are rationally selected from a range of alternatives, to a set of objectives resulting from bargaining between interest groups, political actors and the public to achieve results based on compromise (Lindblom, 1979).

### **3.4.3 - Implementation**

Although this stage is aimed at implementing a policy programme determined by the previous stages in the policy process, this doesn't



necessarily mean that a programme will be adopted. This stage deals largely with the decision to adopt a programme and as such doesn't always result in the action. As political and administrative action is rarely perfectly controlled by objectives, programmes and laws, the intention of a policy is commonly distorted, adapted or blocked altogether in this stage (Hogwood & Gunn, 1984).

For the policy implementation to work it requires several sub-stages; programme specification, resource allocation and decision parameters. Programme specification details the agencies and/or organisations that are required to execute the programme and how the programme will be interpreted. Resource allocation determines how budgets will be distributed and which organisational units and/or personnel will be utilised to execute the programme. Decision parameters identifies how decisions will be carried out on single cases.

Before a ground-breaking study by Pressman and Wildavsky in 1973, implementation was not considered as a stage within the policy making process as the policy making process was assumed to end once a law was passed or government action determined (Bardach, 1977).

The Pressman and Wildavsky study prompted a surge in implementation research as being central to policy research with early research adopting a hierarchical, top-down approach to assessing the outcomes of the implementation of a policy action. Research in this area focusses on how far the implementation is from the initial objectives outlined in the policy formulation stage. Initial studies showed negative coordination to be a key

factor in implementation failures which led to deviations between implementation and objectives. However, other approaches focus on the policy itself and surmise that failures in implementation result from poorly designed policy where causal relationships are based on incorrect assumptions (Pressman & Wildasky, 1984) and (Hogwood & Gunn, 1984). Policy implementation based on a reliance of incorrectly assumed causal relationships will result in unintended consequences of a policy action or will exacerbate the problem a policy action was developed to solve (Sieber, 1991).

The participatory approach in determining policy action in modern societies has led to an acceptance of a bottom-up approach to policy implementation as opposed to the top-down approach used previously. This has led to a greater participation of the government agencies responsible for implementing a policy in the shaping of the policy outcomes (Lipsky, 1980), (Lin, 200), (Hill, 2003). This, along with recognition of the interconnected relationships between policy stakeholders within a policy domain, contradicts the hierarchical understanding of government and society interaction with the policy process. The acceptance of the pervasive way in which government and the public interact in the identification of problems, the formation of policy action and the implementation of that policy action, has led researchers further away from the linear processes of the traditional stages model for decision making.

### **3.4.4 – Evaluation**

The primary role of policy making is problem solving, or at a minimum, problem reduction and it is during the evaluation stage that attention is given to the policy's intended outcomes. In applying the linear policy cyclical model (see figure 1 and figure 2), it is reasonable to assume that evaluation is the final stage of the policy making process since outcomes are evaluated against intended objectives in this stage. However, evaluation as part of policy science considers the entire policy process and it applies the evaluation perspective to each of the stages (Hanberger 2001). In doing so, it seeks to apply largely quantitative research tools to systematically test policy actions in a controlled setting. Despite researchers looking to establish evaluation as a research domain, its application in political free, policy making has been largely considered a failure (Fischer, 1990).

The main issue with this approach is the assumption that policy outcomes are appropriately measured against identified influences and impact. This is further hampered by the assumption that measures of performance used to determine the impact, or influence, of a policy action accurately represent the intended outcomes (Fischer, 1990). Another issue with evaluation, especially when following implementation as part of the cyclical model, is the concept of political bias, where the success or failure of a policy action is viewed from a political perspective. This type of blame-shifting is common in modern politics and the risk averse nature of political policy decision making can lead to vague, ill-defined policy goals which further hampers the ability to accurately evaluate the outcomes (Wildavsky, 1972), (Hood, 2002).

The political landscape can also impact the type of evaluation where legislation, inspectorate bodies, opposition parties, and even the media and wider public, have the potential to act as evaluators of public policy outcomes. However, as policy design moves away from the cyclical model it is possible to evaluate earlier in the process as technology and modelling techniques make it easier to test policy alternatives in a controlled simulated setting (Albeak, 1998).

### **3.4.5 – Policy Adaptation and Termination**

Following evaluation, a policy action is either adapted or terminated. The adaptation of a policy action can lead to a recurrence of the stages of the policy cycle model, highlighting an iterative approach to policy decision making and the continuous nature of the cyclical model (see section 3.3). Where policy action is first adopted in a controlled setting such as a pilot programme, it can lead to a reinforcement pattern and policy adaptation for wider implementation (Benoit et al. 2013). The issues with such an approach is that pilot projects tend to avoid conflict and are risk averse (Jann & Wegrich, 2006) meaning they don't add anything to evidence-based policy decision making.

Policy termination is another outcome of policy evaluation and usually occurs if the policy intervention successfully solves a problem or if the intervention exacerbated the problem. However, changing political landscapes could also lead to politically motivated policy termination, especially when part of an election manifesto. Having said that, termination under these conditions is rarely successful due to the amount of political resistance to change which

leads to the continuation of policies long after their usefulness (Geva-May 2004). The preference by politicians to re-package a policy rather than admit to a failed policy action, provides further incentive to avoid policy termination. It is far more likely for policy termination to occur because of changing ideas driven by an evolving society (Hood, 1994).

### **3.5 – Conclusion**

This chapter has discussed theories, methods and models used in public policy decision-making and highlighted some of the issues in the field of public policy and policy science. The discussion is limited to an overview to provide context to this thesis rather than a comprehensive investigation into the theories, typologies, methods, tools and techniques used in the public policy arena. Each of the theories and models included have influenced the development of the new framework, presented in this thesis, for policy design and analysis and provide justification for a greater emphasis on policy problem investigation.

Although this chapter has briefly discussed the role of data collection and analysis in the context of SCM, and the role of information in the context of NPF, Chapter 4 provides a more detailed overview of information and its relevance, use and dissemination as part policy decision-making in the field of Policy Informatics.

## **Chapter 4 – Policy Information and Policy Informatics**

### **4.1 – Introduction**

The discussion in Chapter 3 highlighted some of the issues with the theories, methods and models used in public policy decision-making and identified it as an extremely complex domain. The reasons behind this complexity according to Dawes & Helbig (2015) are:

- the detailed exploration of the problem domain required
- the correct identification of alternative solutions
- the derivation of evaluation criteria
- the utilisation of diverse information from a diverse range of sources
- the generation of a rich source of information

The information used and generated by the policy decision-making process is given little consideration in the overall context of public policy and is commonly taken as a given (Dawes & Helbig, 2015). This lack of attention has given rise to an emerging field of research in the policy decision making arena known as Policy Informatics. This chapter will focus on the information, as it is used and generated, in seeking solutions to complex public policy problems, and explore the field of Policy Informatics.

### **4.2 – The Use of Information in Public Policy Decision Making**

The theories, typologies, methodologies, tools and techniques, receive considerable focus in public policy research, and when policy decisions are made. However, the information that is used, analysed and generated in the processes receives considerably less focus (Dawes & Helbig, 2015). This

may appear surprising given that public policy decision making is such an information rich environment (Desouza 2011). However, the information focus in this context is related to the reliability and suitability of the information used to support this type of decision making rather than the sheer amount of information (Desouza 2011). This thesis considers the information that is generated and utilised by the policy process and how this is assessed to determine criterion for policy evaluation.

The emergence of the open data movement in modern society and the use of social media platforms to disseminate information have increased the diversely rich amount of information available to policy decision makers (Johnson 2015). Although, if exploited and handled with care, this information can provide policy decision makers with fresh insights and create innovative responses to policy problems, making sense of the overwhelming amount of this information can present challenges (Keller & Staelin 1987). Information is needed to be able to inform and support policy decision making but identifying the information that is relevant from the vast amount that is available requires finding the 'best fit' rather than 'perfect' information (Dawes & Helbig 2015).

The main issue with making decisions in such an information rich environment is the reliance on information from sources that are assumed to be both relevant and reliable and providing information of the same quality (Dawes & Helbig 2015a). The lack of attention given to the reliability of both the information itself, and the sources of that information can lead to poor decision making and, in the context of public policy, this can have far reaching consequences (Houghton & Tuffley 2015).

Another issue regarding the information used to support and evaluate policy decision making is the context in which that information is perceived.

Although information may be viewed as factual and objective, the decision makers are subjective in how they interpret that information (Dawes et al, 2012). Information is usually conceptualised based on the decision maker's own mental model which can add to the ambiguity associated with public policy decision making as different weightings are given to the quality, validity and importance of policy information by different people (Dawes et al, 2012).

In addition to the context in which information is conceptualised and used by the decision maker, the context of the problem situation will also add differences to the way in which information is conceptualised and used. The different uses of information by the different stakeholders involved in the policy process are also likely to cause different levels of demand regarding detail, accuracy and timeliness (CTG, 2000).

The role of information in the policy process is not only to support the policy decision making process but also to support the evaluation of policy options and can be a driver for policy change (Keller & Staelin 1987). However, this presents its own problems; if the information source is based on standardised reporting procedures it may be assumed it has an accuracy and fitness for purpose that may not be the case as the information, even if appropriately managed, will be representative of the organisation for which the information is collected and also the purpose for the collection (Helbig et al, 2010).



Demands for policy relevant information, include information required to identify and assess risk to the policy itself, and to identify and assess vulnerabilities, to the political bargaining power of the policy decision makers (Street, n.d.).

The wealth of information and data available from a multitude of sources in an age of openness and big data, presents new challenges when attempting to interpret that data into a meaningful context for policy decision making, not only in its interpretation but also in terms of quality (Helbig et al. 2012). The following sections will discuss the concepts of quality and fitness for purpose in relation to policy information.

### **4.3 – Information Quality**

To understand the impact of information quality on decision making, an understanding of what is meant by information in the context of policy decision-making is required. The words ‘data’, ‘information’ and ‘knowledge’ are commonly used to represent the same thing but there are distinct differences between them (Bernstein 2011). Data can be described as words, numbers or images that are unorganised; information can be described as data that has been organised, manipulated or processed in a way that provides answers to specific questions; knowledge can be described as interpretation of information to provide fresh insights by making it relevant to the recipient and their use of information (Audit Commission 2007). The Audit Commission definition of data, information and knowledge has been used as they are responsible for overseeing the work of public

services in the UK and as such their definitions are closely aligned with public policy decision-making in the UK.

The focus in this thesis is on information quality, rather than data quality, and the knowledge this information translates to. However, to be able to discuss the concepts of information quality an understanding of data quality is required.

#### **4.3.1 – Data Quality**

Data quality can be assessed using six features; accuracy, validity, reliability, timeliness, relevance and completeness.

Accuracy: data is collected for multiple purposes making accuracy an issue that is closely linked to 'fitness for purpose' in terms of quality. These issues can be resolved somewhat by ensuring that data is collected as close to the creating activity as possible. However, there is commonly a 'trade-off' with accuracy and the other dimensions of data quality particularly, where the need for timely data is prioritised (Audit Commission 2007). The impact on decisions that use this data can be reduced, if the decision makers are aware of any compromise regarding accuracy giving limitations to the data (Orphanides 2001).

Validity: data used to produce information to support public policy decision making will usually be subject to regulation compliance to ensure consistency between organisations, formats, reporting periods and processes (Lee et al. 2002). This is particularly relevant when that data is linked to performance information to aid in the evaluation of policy action.

However, it assumes that the performance measures in place are appropriate.

**Reliability:** Policy action is evaluated against pre-identified performance measures and policy action can be initiated via these performance measures. As such, collection of data across organisations and reporting periods, needs to be reliable in availability, consistency and validity to ensure that actions triggered are due to changes in the data or information and not due to changes in the way the data is collected or processed (Lee et al. 2002).

**Timeliness:** the frequency with which data is made available can have a huge impact on the policy decisions being made, especially when that data is being used to justify incremental policy change or policy termination (Keller & Staelin 1987). However, the idea that data should be collected as soon as possible after a policy action can be detrimental to the success of the policy as a period of adjustment to change may be needed. Public policy impact can be difficult to measure over short periods and the timeliness of data to support the policy process should be appropriate to the intended use of that data (Exworthy 2008). While existing data can be used to inform policy decision making, policy formulation will commonly require new data collections to determine the success/failure of a policy action (Orphanides 2001).

**Relevance:** the intended purpose of a policy action will determine the relevance of data collected to evaluate the outcome of that policy action. Although data should ideally be collected to reflect its intended purpose,

changing political landscapes and societal pressure can make the data irrelevant after a passage of time as needs change (Helbig et al. 2012). An action or event will usually be the trigger for policy reform or review. This would mean that data is collected and evaluated as a trigger either a response to the action/event or will trigger new data collections (Exworthy 2008). Regular reviews of the data collection requirements need to be made to ensure that changing needs continue to be met.

Completeness: information requirements will determine when, how and what data needs to be collected. To make viable policy decisions, as complete a picture as possible is needed. This impacts on the data used to provide information to support the policy process as missing, invalid or incomplete data records could invalidate the decisions being made (Lee et al. 2002).

When data is collected for a specific purpose that is both clear and unambiguous there is little to question about the quality of that data (Dawes & Helbig 2015b). However, quality data doesn't necessarily translate to quality information though it is assumed to do so. The reason for this is that data, without context, is meaningless, and meaning given to the data is ambiguous (Audit Commission 2007). Although rich metadata at the point of collection can preserve the original context, data used in policy decision making has commonly been collected for other purposes and any metadata will reflect that context. The information that such data translates to will depend on the decision maker's interpretation of the data which should take account of its context (Wiess 2011).

The way in which we think and talk as human beings is littered with ambiguity and misunderstandings, but this can be resolved by adding context to the words we use, usually in the form of expression (Kent 1978).

However, there is no such luxury with information derived from data collection and processing, as the same data can be contextualised in different ways by different users especially if there is no context as to how and why it was generated (Munro 2011).

Though the same considerations given to data to determine quality could be applied to information, there is one key factor missing; quantity. The quantity of information available, derived from a variety of data sources, can lead to information overload (Kim & Johnston 2008). Where information overload can lead to ignoring important data, too little information can lead to poorly supported decision making. Finding the balance between the two situations can be difficult and leads us to question which should come first; the need for information, or, informing the need (Keller & Staelin 1987)? However, if information fitness for purpose is looked at separately from information quality we can first identify the purpose and in doing so identify only the information needed to help achieve that purpose. This would mean data collections are established to support the achievement of that purpose or information required for the purpose is extracted from pre-existing datasets.

#### **4.4 – Information Fitness for Purpose**

The concepts of information ‘fitness for purpose’ are like those of information quality and can often be considered as an integral element in determining quality. However, quality information does not necessary mean that it is fit

for purpose and vice versa. Quality information that is considered fit for purpose assumes that the purpose has been correctly identified in the first place. It also assumes that the purpose is fixed and the information needs supporting that purpose are also fixed. Though the same data can support multiple variations in information, and the same information can support multiple variations of a purpose, how much change must occur in the purpose for it to no longer be the 'same thing' and, at what point is it appropriate to introduce new data into the picture?

The idea of 'fitness for purpose' for information in the context of public policy relates to the theories, typologies and methodologies of public policy being used. For instance, if using the Incremental Model, then the information generated would be used to measure the effectiveness of small frequent changes to the policy action and as such would have short term relevance. The same information is unlikely to be relevant for measuring the long-term success of a policy action. A reasonable example of this would be the information to measure performance related to smoking cessation policies, as the benefits of such a policy would take years, if not decades, to be realised.

Information fitness for purpose needs to be considered at every stage of the policy making process, as the same information may not be applicable for each of the stages. As the policy making process needs to be iterative, the information requirements supporting the process also needs to be iterative. The policy process itself also generates information requirements, from which metrics would have to be established. This impacts on data collection, processing and manipulation.

The capability of modern technology has changed the way in which information is collected, stored, processed, visualised and communicated (Kim & Johnston 2008). However, the methodologies, tools and techniques used in policy research have not fully realised the potential of the advances in technology. A focus shift is required to enable researchers to take the field of policy research beyond the use of information for processing, to the exploitation of new technologies to develop novel approaches to understand and address complex policy issues (Kim & Johnston, 2008). The shifting of this focus in policy research has led to the development of Policy Informatics.

#### **4.5 – Policy Informatics**

As an emerging area of Informatics research, defining policy informatics is not easy but one of the most relevant definitions is that of Dawes and Janssen (2013), “an analytical approach that comprises of concepts, methods, and processes for understanding complex public policy and management problems”. As a field of research, it is a systemic approach designed to address the lack of attention given to information when studying the formation and analysis of policies by “applying a combination of computational thinking, complex systems modelling and participatory science” (Johnston, 2015). There is considerable attention given to the technology, tools and stakeholders involved in policy decisions, yet the information generated and used is often taken on faith without question or detailed examination (Dawes, et al, 2010).

Policy informatics, while looking at how information and communication technology can support policy decision making, also allows us to gain greater

understanding of how information is used and shared among organisations and gives us insight into how those organisations behave (Helbig et al. 2012).

The key focus for Policy Informatics is the ability to apply the vast information resources available in an appropriate context. As technology and its capability have advanced, the political landscape of modern societies has changed. The information used to construct knowledge is more widely available from an ever-expanding body of diverse sources. Participatory approaches in government have been made cheaper and easier, due to an increase in pervasive technologies, digital literacy and social media (Johnston, 2015). This means that how information is leveraged into knowledge has changed as the creation and use of information has evolved.

#### **4.5.1 – Theoretical Grounding of Policy Informatics**

Policy Informatics draws on the theoretical foundations of several diverse areas of academic research; most notably Behavioural Economics and Systems Theory.

##### ***4.5.1.1 – Behavioural Economics***

Based on the ground-breaking work of Daniel Kahneman and Amos Tversky in the 1970s, Behavioural Economics is the combination of psychology, cognitive science and economics that seeks to better understand the human decision-making process as a behaviour (Kahneman & Tversky 1979). In policy design, Behavioural Economics is used to design policies with behaviour in mind, looking to identify ‘nudge points’ where small policy changes can be made taking advantage of normative behaviour to achieve



the desired outcomes (Gandell, 2008). In Wales, the use of Behavioural Economics in policy design is evident in the change from 'opt-in' to 'opt-out' in the organ donation policy, which saw organ donation rise by 34% in the first six months following the introduction of the 'opt-out' system (Pritchard, 2016).

Policy Informatics utilises the concepts of Behavioural Economics in allowing the suspension of assumptions of rationality in model design and in the recognition of decision making as a human activity (Kim & Johnston 2008).

#### **4.5.1.2 – Systems Theory**

Systems theory can be described as a non-linear, holistic approach to understanding complexity (Ackoff 1974). Traditionally complexity is understood by using a form of reductionism which reduces the complex domain into sub-domains by breaking down the whole into its parts. While this approach can be useful it can cause issues (Chapman, 2004). Principal among these is that in breaking down complexity into its parts, the purpose of its whole can be lost. This is an issue which systems theory addresses in that, rather than breaking down complexity, it produces different levels of abstraction to enable understanding of the system and therefore does not lose sight of the system's emergent property (i.e. its purpose). Systems theory also provides further insight into the complexity as it seeks to understand the relationships between elements as well as the system's interaction with its environment (Flood, Jackson, 1991). It can help to identify environmental disturbances that would influence the system and as such would be able to determine where adjustments would need to be made to the system to enable the continuation of its purpose.

The idea of systems as a concept began in biology, where traditional reductionist thinking proved inadequate in understanding biological phenomena where respect needed to be given to the identity and integrity of individual organisms whose 'emergent' properties could not be derived from their parts (Flood & Jackson 1991). As the concept began in biology, ideas such as adaptability, development, growth, survival, stability and flexibility, stem from biological analogies (Bertalanffy 1968).

Policy Informatics utilises Systems Theory to better understand the causal relationships that impact on both the policy decision making process and the intended outcomes of a policy action (Johnston 2015). Policy Informatics draws on the model making concepts of Systems Theory to understand and communicate the complexities of modern socio-economic societies and how information flows across the dimensions of society. There is a recognition that public policy decisions have an impact that is multi-faceted and Systems Theory aids in the understanding of that impact (Barrett et al. 2011).

In addition to a theoretical grounding from Systems Theory and Behavioural Economics, Policy Informatics also draws on the concepts of Management Information Systems, Decision Support Systems, Network Science and Complexity Science (Johnston 2015). Particularly in the way in which they leverage computer technology to support the decision-making process (Johnston & Kim 2011).

#### **4.5.2 – Clusters of Policy Informatics Research**

Even though Policy Informatics is a relatively new field of research, three discrete clusters are evolving; Analysis, Administration and Governance.

These research clusters each have an appreciation of complex systems which differs from more traditional linear approaches to policy analysis. Thinking in terms of adaptive systems, organisations, communities and individuals are viewed holistically and, as such problems and potential solutions are considered as a complex network of perspectives, impacts and challenges rather than the linear, singular perspective of individual agencies (Johnston, 2015).

#### **4.5.2.1 – Analysis**

The analysis area of Policy Informatics focusses on gathering and utilising information to provide evidence and insights, and through the visualisation of that information and its relationships, make better sense of the problem situation. Using modelling and simulation, a complex policy environment is visualised to test potential policy action for efficacy under a variety of scenarios and monitoring their associated outcomes.

#### **4.5.2.2 – Administration**

The administration area of Policy Informatics focusses on understanding how technology changes the policy process at both the group and individual level. Using the ability of technology networks to enable and support collaborative governance, information is provided as part of the policy administration process. Information generated by the administrative process is also given focus to enable better understanding of the information flows.

#### **4.5.2.3 – Governance**

The governance area of Policy Informatics focusses on the design of open, collaborative and distributed governance platforms and frameworks

(Johnston, 2015). Using these platforms and frameworks, the innovative practices adopted by open governance can be advanced to create a new generation of public organisations.

#### **4.6 – Conclusion**

With a multi-disciplinary theoretical grounding, Policy Informatics looks to move beyond the traditional methods of public policy decision making, to provide a holistic view of the policy domain (Johnston & Kim 2011). Its focus on information both utilised and produced by the decision process also considers the social information networks advanced by modern technology that are used to produce and disseminate information in the pursuit of enhancing knowledge (Dawes & Helbig 2011).

As Policy Informatics is moving beyond the problem space to the solution space, the information used and generated by the policy decision making process is given greater emphasis (Helbig et al 2012). This emphasis on information means that the quality of that information and the knowledge it engenders is also given greater consideration.

The work that this thesis represents would fall under the category of analysis in the context of Policy Informatics and as such the detailed discussion on methodological choice in Chapter 5 represents this. Chapter 5 introduces a framework for policy design and analysis that focusses on public problem investigation and draws on the key concepts of Policy Informatics.

## **Chapter 5 – Developing an Alternative**

### **5.1 – Introduction**

The introduction of Policy Informatics in Chapter 4 provides a basis for the development of a new framework using its core principles. This Chapter will investigate Operational Research and Problem Structuring Methodologies and consider the methodologies suitable for use with the new framework. Also considered is the idea of mixing methodologies to ensure a full coverage of problem investigation and definition. In establishing the need for an alternative framework for policy design and analysis, past work is critiqued and the common barriers to policy decision making discussed.

### **5.2 – Critique of Past Work**

Theories of public policy and the models used for public policy decision-making were discussed in detail in Chapter 3 along with their advantages, assumptions and limitations. The conclusion of this discussion (section 3.5) identified where critics of the traditional cyclical models called for public policies to be designed.

When summarising the theories of public policy, it became clear that concepts such as social constructs, as in SCF and NPF would need to be considered. Though those concepts can be considered a limitation of the theories, they are also valuable as they call for a design of public policy. Public opinion and public behaviour are key to the successful implementation of public policy. However, though the concept of social construct is valuable, the design of public policy to influence or address a social construct would

fail to fully investigate a problem situation and identify the actual problem.

This is because it would be designing policy based on a limited viewpoint.

This also gives rise to a need to consider IAD theory as behaviour within institutions can play a key role in successful policy implementation. This is evident in the Mid-Staffordshire hospital case where a focus on targets implemented as part of a policy to reduce the waiting time in Accident and Emergency departments fundamentally changed the behaviour of the staff at the hospital.

The work in the field of Policy Informatics, discussed in Chapter 4 (section 4.5), has an appreciation of policy design and an understanding of the need for a more holistic approach (Johnston, 2015).

### **5.2.1 – Barriers to Policy Decision Making**

The complexity and ambiguity inherent in the public policy process can often mean policies fail to achieve their intended goals (Ghaffarzadegan et al. 2015). Regarding public policy decision making, several characteristics act as barriers and are evident in contributing to the failure of policy action.

Whilst these barriers have a lesser impact in the early stages of the policy decision making process, they can have a profound and significant impact during the latter stages of the process (Hanberger 2001). However, consideration needs to be given to the potential for barriers to exist in the very early stages of the process to be able to both break down the barriers and lessen the impact on policy implementation (Ghaffarzadegan et al. 2015).

A significant number of the barriers faced by policy decision makers and the potential success/failure of a policy implementation can be considered as environmental factors (Meter & Horn 1975). They are as complex as the policy decision making process itself, as well as contributing to the complexity of public policy decision making. The challenges faced during the distinct stages of the policy process cyclical model were discussed in chapter 3, section 3.4, whereas this section focuses on the pervasive challenges (or barriers) that are present, often due to environmental constraints. Meter & Horn (1975) describe several key environmental factors that impact on the policy decision making process, particularly those influencing implementation. These include the political, economic and social conditions present at the time that the policy is being introduced, as well as the public opinion at the time of implementation (Ghaffarzadegan et al. 2015).

The culture of the society and political structure in which the policy decision is being made also present barriers to the successful implementation of a policy. In modern, information rich societies, citizens are better informed, which adds to the complexities of policy making challenges, as well as presenting further barriers to policy implementation, as citizens 'push back' against political policy initiatives (Ghaffarzadegan et al. 2015). The political landscape presents additional barriers particularly when policies are introduced that reflect a political ideology, meaning what is considered as a problem to some is not a problem to others (Hanberger 2001).

The key constraints faced during the policy decision making process and implementation can be identified as; political constraints, institutional constraints, and budget constraints.

- Political constraints occur where policy action is linked to a political agenda rather than in answer to a policy problem, or where the political agenda is based on a political ideal rather than a response to a problematic issue. This means the relationship between the proposed policy solution and the policy problem is unclear or that the policy goals are ambiguous (Hallsworth et al, 2011). Policy initiatives require political commitment from the top down to ensure the success of a policy action but all too often the political viewpoint is short term rather than long term, whereas many public policy problems require long term solutions and long-term commitment to those solutions (Ghaffarzadegan et al. 2015).
- Institutional constraints occur where there exists rigidity in the institutions responsible for implementing a policy action. Grace Hopper once said, “the most dangerous words in the English language are; ‘but that’s how we’ve always done it’”. Institutions that are rigid in their processes will often resist change resulting from policy action, especially when that action requires them to adopt new processes and working practices (Bache & Taylor 2003). Institutional constraints can also occur earlier in the policy process when policy problems are framed using an existing institutional culture (Bache & Taylor 2003). This can result in a policy action that aims to fix a *perceived* problem rather than the *actual* problem (De Gooyert 2016).
- Budgetary constraints can occur throughout the policy decision-making process but are particularly relevant during the implementation phase (DeGroff & Cargo 2009). It is reported that implementation is



often one of the most overlooked stages of the policy decision making process and as such little attention is paid to the financial commitment required to implement a policy action (DeGroff & Cargo 2009). The reported rising costs of implementing the Universal Credit policy in the UK are a clear example of where the unintended consequences of a policy have impacted on the budget of implementing that policy.

Initially the plan was to roll out Universal Credit across the UK by 2017 after it was legislated for in 2011. However, the new estimates put this roll out at around five years behind schedule with further cuts to the benefits system leaving a system under pressure and threatening to cause a hike in homelessness (Butler 2018). These situations lead to bigger government spends. This means budgetary constraints can seriously hinder the successful implementation of a policy action and can therefore result in either policy problem exacerbation or in creation of emergent problems (Ghaffarzadegan et al. 2015).

Constraints such as those above reinforce an argument that policy should be designed (Hallsworth & Rutter 2011). To address barriers with implementation of public policy, it is felt that policy design and analysis should include implementation planning. This thesis details the development of a policy decision-making framework to include a methodological approach that considers the common constraints and challenges faced by policy decision makers.

## **5.3 – The need for Change**

An alternative framework for policy decision making is proposed for policy design and analysis with a focus on problem identification rather than following the more traditional policy cyclical models. It is hypothesised that a framework, with clear methodological choices, will have the ability to cope with the complexity and ambiguity that permeates the policy process. In addition, it would need to address the challenges faced by policy decision-makers whilst considering the political, social, institutional and economic constraints. This would require a framework that provides a focus on problem identification and investigation.

### **5.3.1 – Policy Design**

Policy design views the public policy decision making process as a conscious 'design' that considers the tools and techniques used to both achieve a policy goal and to articulate that policy goal. Articulation of a policy goal can be just as difficult as achieving that goal, although policy design consideration can be given to the feasibility and practicality of achieving that goal. The selection of tools and techniques applicable to public policy decision making are often constrained by the existing structures and governance present in the domain such as performance targets, technology and processes. To be effective policy design needs to consider the environment in which the policy action will occur by providing a means to fully investigate the problem domain (Wiess, 2011). The different nuances within different public sectors impact the configuration of how issues are represented. This can be particularly challenging when attempting to design

policy action that is applicable to multiple sectors such as policing, education, health, and welfare. Pioneers of policy design research in the 1980s and 1990s, such as Stephen Linder and Christopher Hood (Lascoumes, P. & Simard, L. 2011), suggest that policy design contains three essential features; the knowledge of the tools and techniques used by the actors constructing the policy, the explanation of how these tools and techniques should be used in the construction of the policy, and an understanding of how to transition the design into implementation (Mcnutt & Rayner 2010). In policy formulation, policy design must consider all outcomes of a policy action linked to the policy problem and in doing so seek to eliminate ambiguity between the policy problem and the policy action.

### **5.3.2 – Policy Analysis**

Policy analysis looks at the causes, processes, formulation, implementation and consequences of public policy (Nduka et al, 2010). It offers an alternative approach to modern public policy problem decision making that questions assumptions and provides a critique of existing structures.

As policy analysis seeks to understand the causes of a perceived problem it provides a much-needed context to the problem domain and can establish if a problem *actually* exists and if so, where it exists. Once the context has been provided and the problem area fully identified, alternative solutions that address the problem can be sought. All alternatives are analysed against existing and desired outcomes to predict the consequences of a policy action.

However, a well formed, comprehensive policy design does not necessarily lead to a well implemented policy action. Once analysis of a policy design has been completed leading to a preferred choice of policy action, an implementation plan should be considered. This leads into the area of governance where the infrastructure, risk, and operational processes are acknowledged. The work within this thesis, whilst recognising the importance of policy governance, has a focus on policy design and analysis.

Taking the Policy Informatics view of analysis, which focusses on gathering information to better understand the problem situation by providing evidence and insights in the form of computational models, the proposed framework will include the high-level theme and provide details of the methodological tools and techniques to be used. This is to ensure that the problem domain is fully investigated. Consideration will be given to the administration area of Policy Informatics. This will include provision of types of information that should be sought to enable and support collaborative governance and the policy administration process.

## **5.4 – Establishing the Methodological Choice**

Policy Informatics is described as a 'systemic' approach or 'systems thinking' approach and as such it stands to reason that the methodologies chosen should fit the category of systemic and/or 'systems thinking' (Desouza 2011). Systems thinking methodologies provide a non-linear, holistic approach to problem solving (Waldman 2007) but a single methodology within this field of thinking would not be enough to tackle all the stages of existing public policy frameworks. Policy Informatics research can be considered as Soft

Operational Research (Soft OR) due to the context in which public policy decisions are made. This is because of its focus on systems thinking practices and the identified need for evidence-based, rather than evidence-driven decision support (Mingers & White 2010). It also considers the inability of mathematical formulations to represent a) complexity; b) uncertainty. The remainder of this chapter will explore the core theoretical grounding of Operational Research, Soft OR and the resulting methodological choices used in this piece of work as they apply to various stages in the policy process.

#### **5.4.1 – Operational Research**

Operational Research (OR) is described as the application of advanced mathematical analytics to support better decision making (Jackson 2006). OR was developed by the British military during World War II, with the aim of applying a scientific approach to better inform decision makers of the most effective and efficient way to utilise their vast resources. In the years since, the field of OR has grown significantly by the inclusion of a variety of diverse disciplines such as engineering, mathematics and statistics and its use being applied to an equally diverse array of problem situations including health, business, social and industrial. Traditional OR is viewed by Ackoff, Arnoff and Churchman as a six-step process (Walley & Pitt, 1981).

1. Formulation of the problem – information is gathered to enable the researcher to sufficiently understand the problem
2. Development of mathematical models – the researcher interprets the problem as a mathematical model

3. Deriving a solution – data is gathered and input into the model ensuring the ability to fully test the model
4. Testing the model and solution – using a variety of analytical tools and techniques to identify the most appropriate solution
5. Establishing controls over the solution - validation of the mathematical model to reliably predict the system's performance over time
6. Putting the solution to work – implementation – although this is usually outside the OR researcher's domain, it is important that both the researcher and the manager implementing the solution work closely together to ensure a successful implementation

Traditional OR has some distinct advantages in decision making as it enables improved control over decisions, systems and organisational coordination but as this field of research grew and developed, it became apparent that OR had significant limitations as well. The most notable being its focus on hard quantitative methods which fail to consider the less quantifiable factors related to decision making in complex environments. Particularly when account is taken of the human factors and the array of human interactions, relationships and behaviours that affect the implementation of the decision solutions (Carter & Price, 2001).

#### **5.4.2 – Hard versus Soft Operational Research**

The above description of OR is often considered to be 'hard' OR due to its heavy reliance on mathematical models and techniques such as Linear Programming, Game Theory, Multiple Criteria Decision Making, Analytical Hierarchy Process and Bayesian Belief Networks (Howick & Ackermann

2011). OR is also described as 'hard' when its primary focus is on the problem itself and the human interaction associated with the problem is a secondary focus and, in some cases, isn't considered at all (Pidd, 1999). The limitations identified with OR are not related to the individual methods or techniques used to develop and analyse the models but rather to its traditional lack of focus on the human element, which is an important part of policy decision-making. This, quite significant, limitation has led to the development and growth of the field of 'soft' OR (Mingers, 2009). Soft OR does not imply that the research or resulting methodologies, techniques and models are somehow less significant or valid than those used in traditional OR, but rather refers to its focus on the softer qualitative methods used to interpret and understand the problem domain. (Checkland 1981) described "the weakness of OR is that it is wedded to logic in a situation in which logic is not necessarily paramount". In other words, OR, requires methods which it doesn't have that enable decision makers to accommodate multiple perspectives; facilitate negotiating joint agendas; function through interaction and iteration; and generate ownership of problem formulation. This is where soft OR has stepped in to address these areas (Heyer 2004).

As problems become significantly more complex and less well-behaved, traditional OR is unable to cope, with its linear, logical and mathematical grounding becoming less applicable in complex situations involving multiple stakeholders and their varied perspectives. Problem situations involving people become 'messy', or as Ackoff (1974) describes it, 'wicked'. For decisions involving public policy action, a soft OR approach is much more acceptable as all public policies involve multiple stakeholders. However, it is

no accident that the policy decision making frameworks that detail the process, are not dissimilar to the process steps described as traditional OR and much like traditional OR, a lack of focus on the problem situation as seen through the eyes of the multiple stakeholders involved has driven the need to increase the focus on the initial steps in both policy decision frameworks and the traditional OR process; i.e. the problem formulation. These are largely ignored in the traditional approaches.

### **5.4.3 – Policy Decision Making in the Context of OR**

There are three general areas of methodological development in OR;

1. Mathematical Models which reflect the logic of diverse yet well-structured, recurring situations as in the traditional paradigm of OR
2. Problem Structuring Methods which reflect the need to understand 'messy' problems which traditional OR methods fail to address, as in the soft OR approaches
3. Methodological Development which reflects the need for combinations of methodologies applied to decision making and can be applicable to both hard and soft OR approaches

While these areas have been present since the foundation of 'soft' OR, there appeared a separation between the systems thinking methodologies of 'soft' OR and the mathematical and computational methods of 'hard' OR (Mingers & White 2010).

Though Policy Informatics as a field of research grounded in OR can be applicable to both hard and soft OR practices, it can be argued that public policy decision making falls firmly in the realm of soft OR due to both its



complex and ambiguous nature. However, as a relatively new field that includes experimentation using mathematical and computational modelling, it can successfully bridge the three general areas of methodological development. It also links OR more succinctly to Systems Thinking which can occur in either 'hard' OR or 'soft' OR and in some cases, can occur within both, such as System Dynamics which combines both qualitative and quantitative modelling.

Most policy decision making models are based on the 'Rationalist Model' first developed by Lasswell in the 1950s and can involve from 5 to 8 steps (see section 3.4). Though the model has been adapted over time it still forms the basis of the cyclical model with the steps being described in much the same way. For example, the rationalist model details step 1 as 'Identify/Define the problem' whereas ROAMEF details step one as 'Rationale'. Both models describe this first step as problem identification and, in some literature, as problem recognition. It is by far the most important step in the process but is also often where the least effort is spent (Punj & Srinivasan 1992). When embarking on the policy decision journey, policy makers all too often believe they have correctly identified the problem situation. Step one in the policy making process assumes that a problem has been recognised and correctly identified but the step doesn't consider if there *actually* is a problem (Fischer et al. 2007).

Recognition of a problem should therefore form an essential part of the first step in any policy decision making model. Only when a problem is recognised and fully understood can we begin to investigate the mitigation of that problem by applying a policy action. Problem Structuring Methods

(PSMs) also form an essential element of soft OR and in identifying the appropriate methodological approach, this thesis seeks to understand the variety of methodologies in this area and their appropriateness to supporting policy decision frameworks.

#### **5.4.4 – An Exploration of Problem Structuring Methodologies (PSMs)**

The idea of problem structuring came from the recognition of a gap in knowledge in traditional OR though it is used in other areas of research and is designed to answer questions such as “How do we go about determining what a sponsor’s problem actually is?” (Ackoff, 1961). While in common policy decision making frameworks phrases such as ‘problem formation’ or ‘problem definition’ are used for the initial stage in the framework, problem structuring seeks to understand the problem situation at a deeper level as it aims to describe the process of developing a sufficient level of understanding of a problem situation to enable a progression to useful solutions to the situation (Woolley & Pidd 1981).

What triggers a need for policy reform is often decided by monitoring outcomes, but what if those outcomes are incorrect or inappropriate. What if we are not measuring the right thing and/or at the right time? Are we dealing with outcomes based on unrealistic targets? What should we be measuring? All these questions are formed whilst seeking to better understand the problem situation and using PSM, the answers are considered as part of the problem structure.

Although the methods reviewed have been developed independently in their own right, they have come to be known collectively as PSMs. To be relevant as a PSM each must be capable of dealing with unstructured problems, which are characterised by Rosenhead and Mingers (2001) as having the following features:

- Multiple actors
- Multiple perspectives
- Conflicting interests
- Important intangibles
- Key uncertainties

In its ability to cope with this set of characteristics, a PSM must:

- Support multiple viewpoints collectively
- Support a participatory process by being accessible to stakeholders with a variety of backgrounds
- Support iteration to allow for changes in the problematic situation and the views of the stakeholders involved
- Support partial improvements as opposed to a global ('one size fits all') solution

The difficulty faced with such strict requirements of a PSM mean that it can be difficult to generalise methods to assess their validity as the success, or failure, of a PSM can be directly attributed to the situation in which it is being applied. It is therefore essential that the chosen PSM is first assessed for its applicability and relevance to the given problematic situation. A chicken and egg scenario?

#### **5.4.4.1 – Strategic Choice Approach (SCA)**

As public policy problem investigation is the focus in the development of an alternative framework and the methodological approach, it is relatively easy to dismiss the Strategic Choice Approach (SCA) as a relevant PSM. SCA is appropriate in areas of situational uncertainty and is particularly useful in situations where decisions are made in the absence of clear facts. As an unstructured problematic situation, the area of public policy is well researched, and, in an age of open government, policy decisions can be supported by very detailed literature, information and data. This area is the focus of the thesis along with a need for a focus on problem investigation as an essential part of the policy decision-making process. This means that although at an operational level SCA may prove useful in the context of policy implementation, as a method for in-depth problem investigation it is considered inappropriate (see table 2).

Having dismissed SCA as inappropriate for use in public policy, the following methods have been given consideration:

- Strategic Options Development and Analysis (SODA)
- Viable Systems Model (VSM)
- Soft Systems Methodology (SSM)
- System Dynamics (SD)

Consideration of these methods will include an assessment of their appropriateness as a PSM; i.e. meeting the relevant criteria to be considered a PSM, and for their relevance and applicability for use in public policy decision making.

#### **5.4.4.2 – Strategic Options Development and Analysis (SODA)**

Based on George Kelly's theory of personal constructs, SODA is a participatory approach that involves a version of cognitive mapping that incorporates bipolar constructs; i.e. two poles (Ackermann & Eden 2010).

The first pole represents a participant's view of the problematic situation while the second pole represents a contrasting, alternative view. The second pole is used to provide additional meaning to the first pole and together they add context and a deeper clarity and understanding of the given situation (Rouwette et al. 2011).

The multiple bipolar constructs are combined to form visual maps which can be examined for their qualitative meaning or developed into graphs for quantifiable analysis (Friend & Hickling 2005).

In the context of a PSM, SODA supports multiple perspectives through the mapping of multiple viewpoints as a participatory process. It encourages conflicting interests with its bipolar constructs and allows iterations through participant discussion. Cognitive maps can be viewed independently or as a collective allowing for partial improvements but can also be quantifiably analysed to form viable 'best case scenario' solutions. These elements make it relevant as a PSM, but not necessarily prove its suitability in public policy decision making. Stakeholders in public policy are not only diverse and varied but also involve multiple organisations, with each of these organisations having their own separate primary goal. It is also limited in mapping the necessary chains of causality that are needed to fully frame the problem context.

#### 5.4.4.3 – Viable Systems Method (VSM)

Developed by Stanford Beer during the 1960s (see figure 4), VSM aims to understand organisations through the five core systems that each organisation, regardless of size, should possess (Gokhale 2002). With concepts of cybernetics theory at its core, VSM seeks to view the organisation through 'cybernetic eyes' (Beer 1984) in order to develop understanding. The five systems of VSM are operation, coordination, control, intelligence and policy which are viewed along with communication and control channels (Mingers & White 2010).

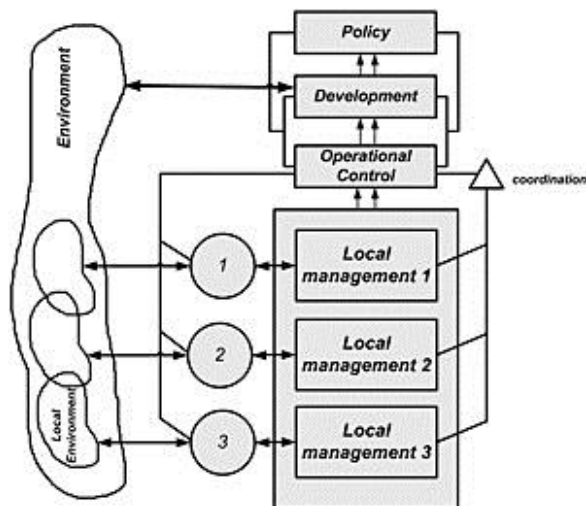


Figure 4: The Viable Systems Model

Although, prescriptive in nature, VSM is often used for organisational restructure but can be key in problem identification where organisations exist that don't appear to fit into the ideal of the VSM. The idea behind VSM is to establish 'dynamic stability' within an organisation and as such it is capable of adapting to changing environments and viewpoints (Beer 1984). This, along with its ability to cope with a participatory approach makes it relevant

as a PSM. Iteration is at the very core of VSM with its ability to model each department or section of an organisation either separately or as a model within the larger VSM, thus allowing for solutions to be applicable to only part of the organisation rather than the whole organisation. This iterative yet holistic approach would also provide a valuable tool for use within the public policy problem domain. However, mapping the causality of problematic situations isn't something VSM naturally supports and the wider public participation in policy decision making could be difficult to model. The use of VSM in public policy decision making would be most useful at the agenda setting stage, where impact of the policy agenda on the various organisations responsible for implementing it, can be modelled to correctly identify communication and collaboration needs.

#### **5.4.4.4 – Soft Systems Methodology (SSM)**

Developed by Checkland and Wilson during the 1960s, SSM seeks to provide a means of structuring the thinking about a given problematic situation. Made up of 7 stages, it is particularly useful in problematic situations that are considered 'messy' and that involve 'Human Activity Systems' (HAS) as described by Checkland (1963). The core of the methodology assumes that all humans and/or activities within a system are working toward some purposeful goal.

SSM is a way of thinking about organisational complexity and it enables communication of that complexity to provide a defensible answer to the question 'what *do* we take the organisation to be?' (Wilson, 2001) SSM focusses on the language of 'what' and seeks to understand the problem situation and clearly define organisational purpose through the formulation of

Root Definitions (RDs) (or statements of purpose). RDs are developed following the identification and expression of a problem situation using 'Rich Pictures'. Rich Pictures are cartoon-like representations of the problem situation used to identify people, process and culture, including potential areas of conflict in the problem context, information, insight and understanding (Reynolds et al. 2010). RDs are then used to create a Conceptual Model (CM) where all activities and their dependencies are logically derived as a means of achieving desired purpose. This allows for flexibility in deciding 'how' purpose is achieved allowing for innovative processes that can easily adapt to a changing political and environmental landscape.

Rich Pictures, Root Definitions and Conceptual Models are the first 4 stages in the 7-stage process that makes up SSM. Figure 5 shows these 7 stages.

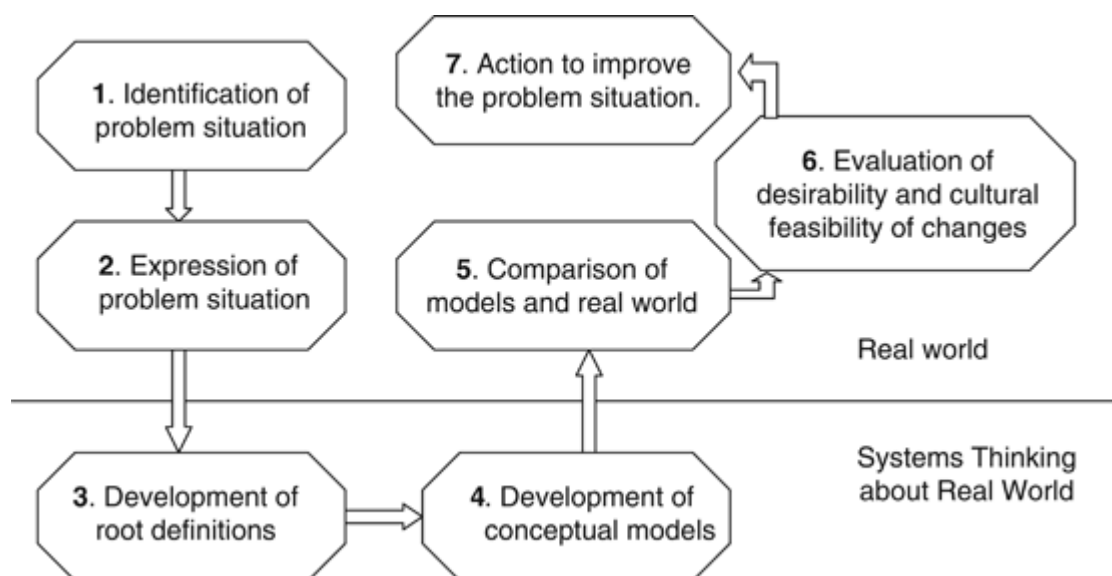


Figure 5: The 7 Stages of SSM



Stages 1 and 2 of SSM seek to understand and express the problem situation using a participatory approach to incorporate multiple perspectives to form Rich Pictures. Stage 3 uses the information gathered to form Root Definitions (RDs). RDs are used to identify and express an agreed 'statement of purpose' and are often formed with the use of the mnemonic CATWOE tool:

- CUSTOMER – the beneficiaries or victims of the system
- ACTORS – those responsible for achieving the purpose
- TRANSFORMATION – the core purpose of the system
- WELTANSHUUNG – the belief that the transformation will be achieved
- OWNER – those with the power to stop the system
- ENVIRONMENT – the elements outside of the system that can directly influence the system

CATWOE can either be used to aid in the formulation of the RDs or it can be used as a 'sanity' check for existing RDs. CATWOE is used in defining RDs; it ensures that all the perspectives are considered as each element in the CATWOE has its own purpose (Bergvall-Kåreborn et.al. 2004).

A real value of SSM lies in stages 5 & 6 and the comparison of CM activities to real world activities through detailed analysis. Gap analysis can clearly identify where budget is lost on the completion of activities that offer no, or little value in achieving the organisational purpose. As all CM activities and dependencies are logically derived, then by that same logic only those activities are needed to enable the organisation to achieve its purpose.

Further analysis can identify what information is needed for the completion of each activity, where exchange of information is needed, and critically, identify where measures of performance are required that are both useful and relevant, and shift the focus from efficiency to effectiveness. This means that performance measures become 'fit for purpose' and support the achievement of the organisation's core purpose.

Having used the analysis of stages 5 & 6, stage 7 should include the action plans to enable the implementations of changes identified. As SSM examines the culture of an organisation and potential areas for conflict in its early stages it is often used in areas of change management and organisational process redesign (Wilson, 2011).

As an approach SSM meets all the criteria of a PSM, however, the cognitive effort required to complete the seven stages means that, even though it can be considered iterative, it can be time consuming to adapt to cope with changes during the latter stages. Having said that, SSM can be developed to include activities that support changing viewpoints and its initial consideration of environmental constraints mean that activities to support internal organisational change and adaption necessary because of changes from external sources can be built in to the models.

The ability of SSM to cope with extremely complex situations and its consideration of HAS also makes it appropriate for use in public policy decision making. This is due to its ability to support and model multiple perspectives linked to the problem domain.

#### **5.4.4.5. – System Dynamics (SD) as a PSM**

System Dynamics (SD) was described by Coyle (1991) as dealing with “the time-dependent behaviour of management systems with the aim of describing the systems and understanding, through qualitative and quantitative models, how information feedback governs its behaviour, and designing robust information feedback structures and control policies through simulation and optimisation.”

SD focuses on the structure element of systems theory where a system is assumed to be a collection of parts organised for a purpose (Coyle 1996). Using stocks and flows as a means of representing reality, SD helps to identify unintended consequences by determining influential factors within the system structure. Unintended consequences can occur when efforts to fix a problem in one part of the system merely moves the problem to another part or creates an even bigger problem in another part (Georgiou 2012). It is not unheard of for a solution to create a bigger problem.

The systems boundary, within SD, is defined by the size of the model created, but it can be flexible as iterations modify the model and allow it to grow to include all relevant factors.

The concept of Information/Action/Consequence is central in SD, as figure 6 demonstrates. The loop shows the ‘state’ of the system and the ‘D’ on the links indicates substantial delay, particularly between choice and state where consequences can occur as a result of actions made based upon information received (Coyle 1996). The sequence of these elements is dynamic behaviour and is dependent upon how well information and actions are in

tune with each other and the way in which consequences arise, considering the delays. System Dynamics deals specifically with the tuning of the system to ensure that the sequence is as acceptable as it can be. Key to the sequence shown is recognising it as a loop. There are two types of feedback loops; 'negative' and 'positive'.

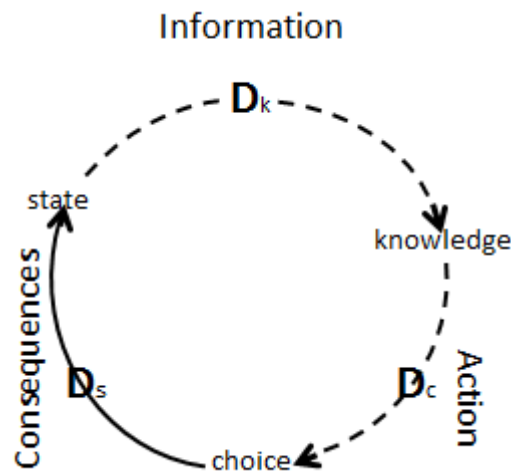


Figure 6: The information/action/consequence paradigm of system dynamics (Coyle 1996)

#### 5.4.4.5.1 – Negative Feedback Loops

Negative feedback loops are also referred to as 'goal-seeking' or 'balancing'. The main idea of a negative feedback loop is action, in the form of a systems policy. This is generated when there is a difference between the actual and desired level within a system in an attempt to eliminate the difference (Coyle 2000). As with all discrepancies between an actual and desired state, there exists a delay in the elimination of the difference. Though referred to as 'balancing' this is not always the case as a poorly defined feedback structure can lead to an unbalancing of the system (Schaffernicht 2007).

#### **5.4.4.5.2 – Positive Feedback Loops**

Positive feedback is also referred to as 'growth-producing' or 'reinforcement' loops and their existence in a system may prove valuable as a means of growth (Coyle 1996). However, a change parameter that controls the growth may also result in decline moving the system from a virtuous circle, where growth is good, to a vicious circle, where the decline could prove devastating (Wolstenholme 2004). Where positive feedback loops clearly lead to an undesirable end, then it is important for them to be designed out (Ghaffarzadegan et al. 2015).

'Positive' in terms of feedback refers to the flow of polarity rather than referring to 'positive' as a 'good' thing. Whereas 'negative' in terms of feedback is a 'good' thing as it indicates 'balance'. Thus, 'positive' in terms of feedback is a 'bad' thing as it indicates 'imbalance' (Coyle, 1996).

SD uses stocks and flows as a way of thinking about reality. Stocks can only be affected by flows, and flows are controlled by policy decisions, external factors, and feedback from other parts of the system (Luna-Reyes et al. 2007). This system's behaviour is determined by the structure of relationships. Delays in the system make control more difficult, as it takes time for the outcome of actions to become apparent (Schaffernicht 2007). Effective management control requires timely measurement of the right factors, as well as good decision making on how to react; "good" decisions require an understanding of systemic structure.

#### **5.4.4.6 – Summary of PSM Methodologies**

Problem Structuring Methodologies seek to enable the understanding of problem situations at a deeper level. For a methodology to be considered a PSM it must contain features that allow multiple viewpoints from multiple actors faced with situational uncertainty. It must also be able to support a participatory process and allow for changes in stakeholder views and situations. The methodologies discussed in this section all contain these features but not all of them can be considered appropriate in the field of Policy Informatics. Neither can they all be considered appropriate for use in public policy decision-making. This is either because the type of decision-making supported doesn't contain the complexity that is public policy or cannot support the mapping of causality to fully investigate the problem situation. Table 2 provides a brief summary of the PSMs considered and their appropriateness of use in the field of Policy Informatics and public policy decision-making. Each methodology is assessed for features and characteristics consistent with PSMs (see section 5.4.4), the features consistent with Policy Informatics (see Chapter 4, section 4.5) and their usefulness for public policy decision-making and problem investigation.

Table 2: Comparison of PSMs

<b>Methodology</b>	<b>PSM Features</b>	<b>PSM Characteristics</b>	<b>PI features</b>	<b>Usefulness for public policy decision making</b>	<b>Usefulness for problem investigation</b>
<b>SCA</b>	Contains features consistent with PSMs	Contains characteristics which are consistent with PSMs	Is not strictly a 'systems thinking' approach so doesn't contain the necessary PI features	At an operational level SCA can prove useful especially by organisations implementing a policy with a lack of clear direction	As the main purpose for SCA is making decision in the absence of clear facts, it is not appropriate for in-depth problem investigation
<b>SODA</b>	Contains features consistent with PSMs	Contains characteristics which are consistent with PSMs	Though not a strict 'systems thinking' methodology SODA can be mixed successfully with other methodologies to meet the necessary PI features	SODAs bipolar constructs make it difficult to include all stakeholders	Limited in the mapping of chains of causality making it difficult to fully investigate problem situations
<b>VSM</b>	Contains features consistent with PSMs	Contains characteristics which are consistent with PSMs	A systems approach meeting the necessary PI features	The multiple viewpoints, stakeholders and organisations involved in policy decision making could make it difficult to model	Unable to support the mapping of causality to fully investigate problem situations
<b>SSM</b>	Contains features consistent with PSMs	Contains characteristics which are consistent with PSMs	A systems approach meeting the necessary PI features	Can cope with multiple viewpoints, stakeholders and organisations	Is specifically used to define problem situations
<b>SD</b>	Contains features consistent with PSMs	Contains characteristics which are consistent with PSMs	A systems approach meeting the necessary PI features	Can cope with multiple viewpoints, stakeholders and organisations	Is specifically used to define problem situations

#### **5.4.5 – Mixing Methodologies: Toward a Multi-Methodological Approach**

In identifying an applicable methodology, care needs to be taken to ensure that it is not only appropriate for the chosen case study, but that it is also appropriate in supporting the policy decision making process. The third stream of methodological development in OR looks toward a combination of methodologies to support decision making. When considering a multi-methodological approach there are three forms of linkage that can be considered; comparison, integration and enrichment (Howick & Ackermann 2011). Each of the three forms are equally valid but when choosing a multi-methodological approach, it is important to consider the domain in which they are being applied (Mingers & White 2010). This section reviews the methodologies described as PSMs that can be applied in a multi-methodology approach that not only supports the structuring of problematic situations but can also support the remaining steps in the policy decision making process. For this reason, it has been limited to mixes using SODA, SSM and SD.

##### **5.4.5.1 – SODA and SD**

Cognitive mapping can be considered as a type of Influence Diagram; these are commonly used as an element of System Dynamics and can be used to form the basis for System Dynamics simulation models (Rouwette et al. 2011).

As such SODA's causal cognitive mapping is often used as a precursor to SD quantitative models. It can aid in defining the boundary of the SD models



and SODA's participatory approach can ensure multiple viewpoints or the consensus viewpoint is considered. However, the value of such an approach can be brought into question when consideration is given to the similarities of SODA and SD as both SODA and SD attempt to map the causality of a given problematic situation. The key difference between the two is that while SODA's causal constructs are purely qualitative, SD Influence Diagrams or Causal Loop Diagrams are created with factors that are, at the very least, theoretically quantifiable. For example, with a SODA map, we can say that clouds cause rain whereas in an SD model we link 'vapour content of cloud' to 'level of precipitation'.

With this in mind, one can argue that any value gained from a SODA causal cognitive mapping can be gained from creating an SD Influence Diagram. Also, the additional cognitive load involved in translating purely qualitative constructs into the necessary quantifiable factors required for simulation modelling is largely avoided. However, advances in the software used to create SD models can provide another use for SODA mapping in the creation of SD models, if the concept of modular modelling is used. Modular modelling allows for multiple levels of abstraction and the 'rules' of SD modelling can be suspended for high level modular models. It is in this area that SODA causal constructs can prove more valuable as the SODA map can provide the necessary linkage to the lower level models. SODA causal maps are scored to determine the best course of action in a problem situation and this scoring can be used to help validate the concepts being tested in the lower level models. This additional quantifiable validation can aid in the acceptance of the SD simulation results.

#### **5.4.5.2 – SODA and SSM**

The concept of bipolar constructs in SODA can represent both the undesired and the desired state. This can easily be translated into the 'Transformation' element of an SSM Root Definition. One of the core concepts of SSM is the 'transforming' of a problem situation from an undesired state to a desired state. SODA's bipolar constructs lend themselves to the formation of Root Definitions enabling the development of models that represent multiple viewpoints. However, the value of using SODA with SSM is dependent on which version of SSM is being used; either Checkland or Wilson. Wilson's (2011) version of SSM includes a modelling technique known as Consensus Primary Task Modelling (CPTM) that utilises an 'Enterprise Model', which views an organisation as four distinct systems. It was developed to enable the inclusion of multiple viewpoints and perspectives in a single model.

The value of SODA with SSM is in using bipolar constructs to create multiple root definitions based on multiple viewpoints of a problem situation. This is primarily applicable if using Checkland's approach to SSM. However, in this approach, although multiple viewpoints are expressed as Root Definitions, they result in separate Conceptual Models rather than a single model incorporating multiple perspectives. This means that the value of SODA with SSM is wholly dependent on the version of SSM being used, which in turn depends on the problem situation being investigated (Mingers 2008).

Examples of SODA and SSM being used together have been in areas of high uncertainty or where little information on the problem situation is available (Georgiou 2012). Although certain problematic situations are

considered problematic due to their ambiguity, this doesn't always translate as uncertainty regarding the amount of information available.

#### **5.4.5.3 – SSM and SD**

The theory behind both SSM and SD are widely published as the two methodologies are often taught together in UK institutions which has led to experimentation with their use as a multi-methodology (Lane & Olivia 1998). Some distinct differences in how these two methodologies are 'mixed' to form a multi-methodological approach has occurred. However, in each case the mixing of the methodologies is done to address the common criticisms made about using either SSM or SD as a single methodology.

In one mixing of the methodologies, known as SSDM (Soft System Dynamics Methodology), which is based on the work of Rodriguez-Ulloa (1999), a ten step process is used to clearly identify the problem situation and potential solutions that are both systemically feasible and culturally desirable (Rodriguez-Ulloa & Paucar-Caceres 2005). Thinking in terms of three 'worlds', SSDM conceptualises the 'real world' (World 1) to understand the problem situations. The conceptualisation of the real-world problem is considered 'World 2', and 'World 3' is the Solving-Situation System Thinking World. This is where potential solutions to the problem situation are identified following detailed analysis (Rodriguez-Ulloa & Paucar-Caceres 2005).

This introduces the concept of Systems of Systems, where each of the 'worlds' can be considered a separate system. The System of Systems Approach (SOSA) that exists in Systems Theory is considered by Hitchins

(2009), as the “ultimate tautology”. He argues that a system, as it is made up of interconnecting parts, could, in itself, be considered a system of systems. However, it may be possible to exploit learning, aid thinking and communicate understanding by considering ‘System of Systems’ as a concept.

In the UK, and more widely through organisations such as INCOSE (International Council On Systems Engineering), the term ‘System of Systems’ has been adopted to refer to a ‘real world’ entity that “contains systems which have purpose and are viable, independent of the System of Systems, but which can when acting together perform functions unachievable by the individual systems acting alone” (INCOSE, 2010). This is especially true for public policy decision-making which requires the involvement of multiple organisations and stakeholders (systems) who, while working to individual priorities, goals and objectives, come together for the purpose of implementing a policy action.

Other approaches to mixing the two methodologies take a more theoretical stance, where SSM and SD are considered for synthesis based on their conceptual assumptions (Lane & Oliva 1998). In this synthesis, the SSM conceptual representation of multiple perspectives is also given the causal representation based on SD structures and relationships. This requires the production of Conceptual Models with the concept of causality at their core (Gregory, 1993). Though the use of SD and SSM together in the synthesis described by Lane and Olivier has yet to be tested in a practical application this could provide a valuable and novel approach to public policy decision-making.

#### **5.4.5.4 – Mixing Methodologies Summary**

The methodological choice when proposing either a new framework or when enriching an existing framework is extremely important, as the

methodologies chosen, need to fit multiple criteria for them to be applicable.

The concept of multimethodology is using more than one methodological choice, either in full or in part, in a single context. The methodological choice for this thesis is SSM and SD, though not in the combination of SSDM proposed by Rodriguez-Ulloa (1998) but more in the vein of the theoretical synthesis proposed by David Lane (1998). However, it will also consider the concept of SOSA that is present in SSDM. The reason for the choice is that SSM provides a robust framework for problem structuring while SD adds causality in its qualitative form, and in its quantitative form, enables a robust analysis of the policy alternatives.

Table 3 provides an overview of the multimethodological choices considered here. The remainder of this chapter details how the proposed framework was developed to utilise the methodologies to form a multimethodological approach which enables a full and thorough investigation into the problem space when making policy decisions.

*Table 3: Summary of Mixed Methodologies*

<b>Multi-Methodology</b>	<b>Key Concepts</b>	<b>Limitations</b>	<b>Advantages</b>
<b>SODA &amp; SD</b>	Both map the causality of a problem situation with SODA using cognitive mapping as a causal diagram and SD mapping chains of causality	Purely qualitative, increased cognitive load when translating diagrams from SODA to SD	Can help define the boundary of SD models. Can provide additional validation if SODA is used as a precursor to SD
<b>SODA &amp; SSM</b>	Both use concepts of transformation	SODA only fits with Checkland's	SODA provides desired and

		version of SSM and doesn't support 'Enterprise' modelling	undesired states which fit with the transformation process of SSM. Can provide the base for multiple RDs to represent multiple viewpoints.
<b>SSM &amp; SD</b>	Focus is on problem definition and exploration. While SSM seeks to define the problem situation through RDs and CMs, SD uses causality maps to investigate a problem situation	Little work is available to support the use of SD and SSM as a multi-methodology.	The mixing of SSM and SD could lead to a 'full' view of the problem situation which includes identification of potential solutions. SD simulation could test those potential solutions to identify the 'best fit'

## 5.5 – Developing a New Framework for Policy Design &

### Analysis

In the previous section the concept of multimethodology was introduced for use in proposing and developing a new framework for public policy design and analysis that fits within the field of Policy Informatics. The remainder of this chapter focuses on the methodological choices and how it can be used to develop a new framework that is an alternative to the more traditional cyclical frameworks currently used in public policy decision-making. It will consider the traditional cyclical policy process and how this can be enriched by the application of the chosen methodological approach. It also discusses common barriers to public policy decision making, the role of qualitative and conceptual modelling in policy decision making, and the role of qualitative modelling in support of evidence-driven policy decision making.

### **5.5.1 – Enriching the Policy Process**

One of the biggest criticisms of the traditional cyclical models of policy decision making are their linear structure (Stone et.al. 2001). Although it can be argued that breaking down the policy decision making process into discreet stages and sub-stages enables a better understanding of this complex area by simplifying the process (Sabatier, 2008), this reductionist view fails to consider the unpredictable and ambiguous way in which public policies are received (Sutton, 1999). Public policy decision making occurs in an environment that is equally unpredictable and ambiguous and, in many cases, in highly emotive contexts. Particularly when that policy decision-making occurs in areas of public health and welfare.

Looking at the methodological choice in the context of the cyclical model helps in understanding the requirements needed to create a robust framework for public policy design and analysis. When applying a methodological choice to a given context, it is useful to apply the approach to a simplified pattern to ascertain the usefulness of the methodological choice. The cyclical model is a simplified model of policy decision-making and can provide that simplified pattern. Even within Systems Theory, which promotes a holistic approach, the steps to apply Systems Theory's methodologies to a domain are in themselves linear, yet each step is considered iterative. It is the holistic thinking of the domain whilst completing each of these steps that is most valuable as it ensures the focus never strays from the context in which the problem exists.

With this in mind, the 7-stage cyclical model (Schmitz 2012), depicted in figure 7, has been used as a basis for applying a systemic approach using Systems Theory Methodologies. This is because it contains the steps outlined in the Rationalist model and ROAMEF which are the most common cyclical models used for public policy decision-making.

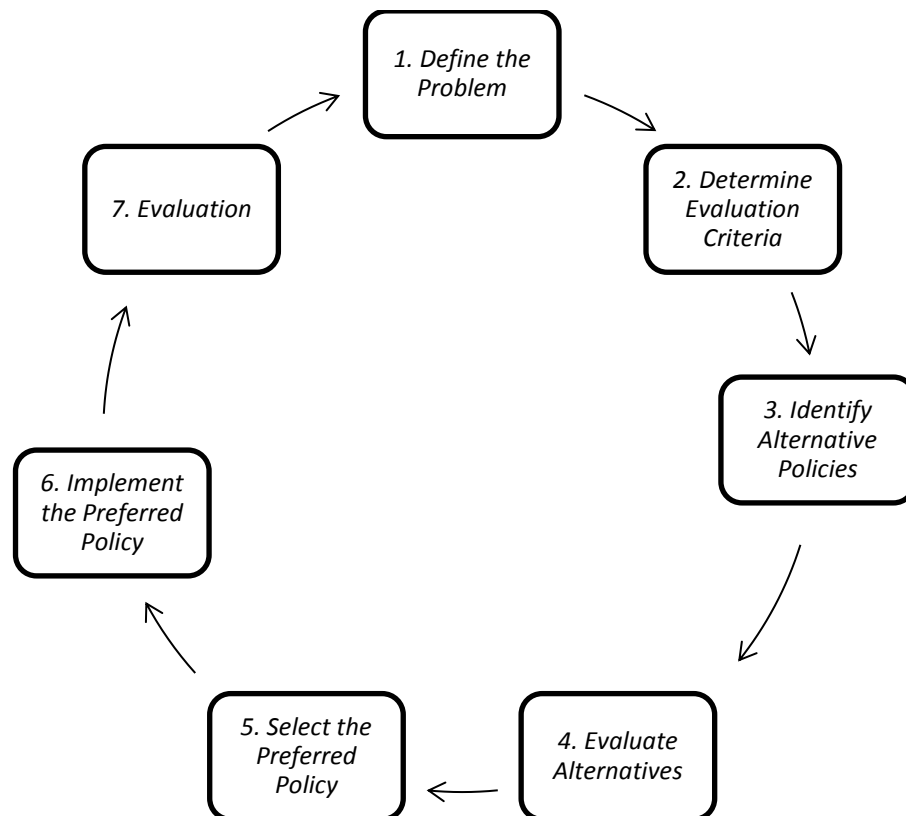


Figure 7: Policy Decision Making Cyclical Model

Each step in the model shown in figure 7 will be discussed in the context of methodological choice for a revised framework.

#### **5.5.1.1 – Define the Problem**

Problem definition is a complex concept as discussed briefly in chapter 3, section 3.4.1. ‘Agenda Setting’. However, this assumes that the problem has been correctly identified in the first instance. The problem definition



stage of policy making includes problem recognition, but this is often overlooked by policy decision makers as assumptions made about the problem are rarely questioned. This step assumes that a problem has been recognised and correctly identified, but how *do* we know if we have a problem, is an important question.

This difficulty in problem recognition and definition led to the growth of PSMs in OR, but it is particularly true in the context of policy decision making (Houghton & Tuffley 2015). However, problem definition, whilst appearing as the first step in the process, is permeated throughout the entire process, as issues with problem definition persist from evaluating alternatives, to developing solutions, to implementation (Wiess, 2011).

What triggers a need for policy reform is often decided by monitoring outcomes, but what if those outcomes are incorrect. What if we are not measuring the right thing and/or at the right time? Are we dealing with outcomes based on unrealistic targets? What should we be measuring? These are the questions that OR practitioners seek to answer through the use of PSMs and are considered when seeking to enrich the policy decision making frameworks. These questions, or rather the ability to answer these questions, is considered when making the methodological choice. As a PSM, SSM is particularly valuable in focussing on the 'what' in the context of the problem domain and it provides a reference model for what the situation seeks to be, rather than what it is. The concept of seeking to understand the situation in its desirable state, starts with an understanding of the problem situation as it exists. SSM does this through the development of Rich Pictures. Although Rich Pictures are usually expressed as cartoon-like

representations of the problem situation, in the context of policy decision making, the mapping of cause-effect relationships within a problem domain is considered more useful than Rich Pictures in the recognition of a problem. SODA maps provide an element of causal understanding, but the resulting cause-effect chains lack the necessary richness to fully understand the relationships between the many relevant variables. Applying SD, however, results in multiple chains of causality which encourage a deeper level of understanding of how the multiple relationships, variables and causes produce a behaviour (Richmond, 2001).

Therefore, what is required in the problem definition stage is a merging, or mixing, of the two methodologies SSM and SD, to both provide an 'as is' picture of the situation, and a frame of reference of the desired situation with which to compare. In doing this it is possible to identify areas of conflict and highlight potential conflict resolutions. In this merge, SD influence diagrams are used as steps 1 and 2 of SSM (see section 5.4.4.3, figure 5) as the models produced provide the identification and expression of the problem situation. These models are then used to support the formulation of SSM Root Definitions. The methodologies and how they are used in the context of public policy decision-making is detailed in figure 8.

Figure 8's orange boxes show where the methodological choice can be applied to existing cyclical frameworks to add richness to the policy decision making process.

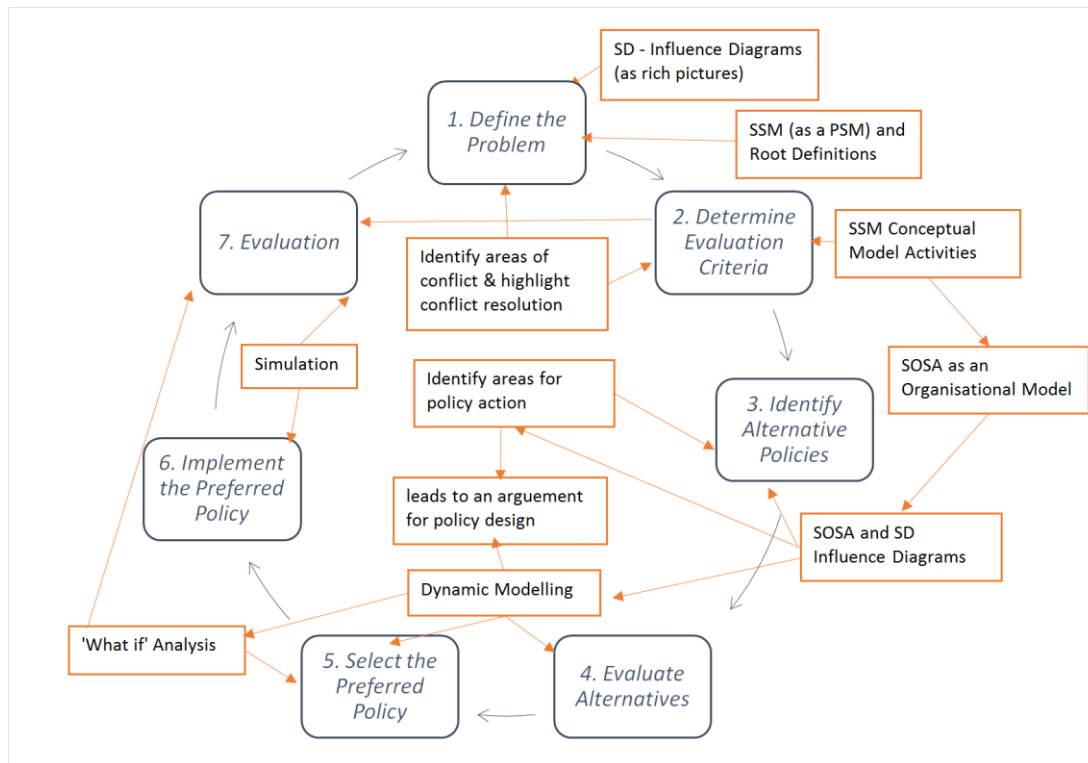


Figure 8: Detailing the methodological choices that can be added to existing frameworks

### 5.5.1.2 – Determine Evaluation Criteria

Research into the evaluation stage of the policy process is both rich and varied with many agreeing that evaluation needs to occur at each stage of the process (Parsons, 2002). However, to evaluate the effectiveness of a policy action, the criteria for evaluation must first be established. The conceptual models created as part of the process of SSM include identifying the measurement and control activities needed. This means that evaluation is considered as an essential element of the problem definition, whereas traditional cyclical models, consider determining evaluation criteria as step 2 in the process. As a PSM, SSM answers the question; what should we be measuring? It also provides the rationale behind the metrics used to measure and evaluate the desired outcomes.

In addition to identifying and developing evaluation criteria, the methodological choice must also enable continuous learning within the policy problem domain. The provision for the mechanisms to enable and encourage learning fits with the concept of policy action as a continuous process, whereby policy decisions take place in an evolving environment. In other words, situations where the boundaries between where a policy decision begins, and ends, are blurred. Policy decisions are often made in response to changing circumstances in an existing policy context, be that through increased media or public attention or through changing political ideologies (Boscarino, 2009).

The evaluation criteria are based on desired outcomes and to correctly identify these, a model representing the 'ideal' is created to act as a frame of reference against which measurements are compared. SSM provides this in the form of a Conceptual Model. Conceptual Models can only be formed after the problem situation has been investigated and expressed. The RDs formulated provide the basis for the CM and the validity of a CM can be tested by comparing the language used in the CM to that used in the RD. These steps in the SSM process are iterative and the development of the CM can lead to changes in the RD. This differs from the more traditional cyclical models of policy decision-making as, whilst some evaluation criteria are identified in their step 1, this is linked to existing outcomes rather than desired outcomes. This is because their step 1 looks at the 'as is' situation rather than the 'ideal' situation. The proposed framework addresses this by using SSM to identify the 'ideal situation'.

Whilst SSM is particularly useful in identifying monitoring and control activities, it cannot consider all the evaluation criteria needed. The causality mapping of SD can help in identifying where policy action leads to unintended consequences and these unintended consequences, in addition to the desired outcomes, need to be monitored.

#### ***5.5.1.3 – Identify and Evaluate Alternative Policies***

The initial evaluation criteria provide the grounding for the direction of a policy decision in addition to providing the rationale for the continuation of a policy action. It also leads to fresh insights into the problem itself and into the development of alternative solutions. If MSA is considered then it is possible that as problems are identified, potential solutions are also identified which means the evaluation criteria relevant to both the problem and potential solutions are also identified. This would lead to a merging of steps 2 and 3 (see figure 8) where evaluation criteria and alternative actions are considered as part of the problem identification. Whilst there are flaws in the theory of MSA, the way in which human beings make decisions make it an entirely plausible approach. However, a difficulty arises when multiple perceptions of a problem domain lead to multiple solutions, all of which could be relevant. Thus, a methodological choice is required that can represent the multiple perspectives, not only in the identification of the problem but also in the identification of policy alternatives.

The methodological choices for identifying and selecting policy alternatives needs to consider the complexity of multiple stakeholders, perspectives, evaluation criteria and causality. It also needs to cope with the idea that what may be considered a desired outcome from one perspective may be

considered undesirable from another. This means that care needs to be taken to ensure that assumptions are questioned where possible and suspended where appropriate. SD can provide a suitable platform, through its careful mapping of causality, to identify and fully test potential policy action. As causality is mapped as part of step 1 this means that solutions are considered as part of the problem, therefore supporting the theory of MSA in a more robust, holistic way.

SD has a rich history of use in policy decision making but it is possible to create SD models to fit an idea and add credence to an assumed solution rather than questioning that assumption. This is where the creation of a 'frame of reference' in the form of Root Definitions and a Conceptual Model proves particularly useful in guiding the SD model to fit the investigation of the problem domain rather than fit the assumed solutions. This is particularly true when modular modelling is used as the modules are created to match the high level conceptual model.

Potential solutions identified using the assumptions of what the problem is perceived to be, rather than what the problem is, only leads to 'fixes that fail' and either exacerbate the existing problem or create new problems. A detailed investigation into the problem domain using a PSM such as SSM will help alleviate these issues, providing the SSM used has adequately captured all the necessary perspectives. If this is the case, then the resulting evaluation criteria can successfully evaluate the success or failure of policy action.

#### ***5.5.1.4 – Selection, Implementation and Evaluation of Preferred Policy***

The selection of a preferred policy action results from performing detailed analysis on the alternatives. Using SD, this can be achieved with relative ease by performing a 'what if' analysis of the options. Policy alternatives are identified through studying the loop structure of SD qualitative models where the need for policy action is also established. The policy action is then tested using simulation of a quantified model to ascertain the impact on the desired outcomes.

As well as using the simulated environment to test the rigor of potential policy action in solving the agreed problem, SD can also consider the constraints and address issues by linking multiple models together to test the impact on other areas of the system. For example, service delivery simulations can be linked to financial simulations to ascertain the impact of changes in service delivery on budget.

The use of SSM consensus models that include multiple perspectives can address environmental constraints early in the process and the SD models developed, using the SSM consensus model as a frame of reference, provide the analysis to address these constraints.

Policy interventions are often intended to tackle specific problems, but the impact of policy action is often indirect and can take time to be realised so solutions proposed should be tested using a variety of timescales to fully identify unintended consequences and address the issue of emergence.

Adding richness to existing frameworks addresses the concerns, highlighted by Hallsworth (2012), where policy decision-makers criticise the lack of

guidance and clarity on *how* to achieve each of the steps. But this is only part of the story. The methodological tools and techniques, highlighted in orange, in figure 8, are used to enrich the more traditional cyclical policy frameworks but they also emerge as the basis for an alternative framework as the steps in the process become ‘blurred’ or merge. An alternative framework should also address the constraints, challenges and issues of policy design and analysis as discussed in section 5.3.

## **5.6 – Conclusion**

This chapter provides an in-depth discussion on the methodological choice to support a new framework for policy design and analysis. It discusses how the methodologies and the mixing of the methodologies adds richness to existing cyclical frameworks. In doing so it addresses the criticisms that researchers such as (Hood 1991), (Hallsworth 2011a) and (Nduka et al, 2010) have made of the policy cycle as they argue a case for policy design.

It is important to note that the thesis does not seek to replace the cyclical framework but rather offer an alternative that focuses on policy design. Thus, the proposed framework does not go as far as an implementation phase but offers insight on this stage of implementation planning. This is because an alternative framework focuses on policy design and analysis and the methodological choice when applied to the cyclical framework (see figure 8) uses ‘simulation’ to select and evaluate alternative policies with implementation only existing in a simulated environment.

The methodological choice that underpins the new framework can cope with the complexity and ambiguity that permeates the policy process whilst



considering the political, social, institutional and economic constraints that permeate the public policy process.

The next chapter introduces three case studies and discusses how they led to the evolution of the framework and how elements of the framework are applied in these case studies. Each of the case studies is used to test the validity of the methodological approach in the context of policy decision-making and how the methodology fits into the new framework.

## **Chapter 6 – Evolving and Applying the Framework**

### **6.1 – Introduction**

In this chapter the concept of case study research is introduced. It covers the contribution of the case studies in the evolution of the new framework and introduces the new framework. It also discusses the concept and value of a participatory approach in the creation of models and examines, in detail, the application of the methodological choices as they apply to each of the case studies. Though there will naturally be some evaluation of the tools, techniques and methods discussed in this chapter, the main evaluation of the proposed policy design framework, and the methodological choices made to support it, are discussed in the next chapter. The focus of this chapter is on evolution of the framework and its initial stages; establishing the context, framing the problem, identification of information needs, and the early stage information analysis.

To identify an appropriate case study suitable for testing the methodological choice, several essential criteria need to be established. Firstly, the case study must be considered a public policy problem and as such contain the following features:

- Intrinsically complex
- Multi-disciplinary
- Multiple perspectives
- Multiple stakeholders
- Multiple sources of information

In addition, the case study should possess the potential for research in the target domain to have impact on policy making within it. The case studies in this chapter will be presented in the order in which they were used and detail the insights and learning gained from their use and how this evolved into the new framework for policy design and analysis.

## **6.2 – Case Study Research**

Using a case study in research can take two types of form:

*Intrinsic Case Study* which considers a single case on its own merits and has no expectation that the outcomes will provide insight to other case studies (Eisenhardt, 2016).

*Instrumental Case Study* which considers a single case to explore a theoretical approach or phenomenon. This type of case study is used to generalise or develop theory and has an explicit expectation that the theory or phenomenon can be applied to other case studies (Flyvbjerg, 2016).

When using a single case study in instrumental case study research, the ability to generalise can be difficult (Yin, 1984). It is therefore important to be clear on the purpose for using a case study. If the case study is being used to expand or generate theory, then the important factor is the learning achieved from the application of the case study in the research (Yin, 1984). However, if the purpose is to prove a theory then the use of a single case study can be problematic as the outcome may only be true in this study. If several case studies are used, then the scope for generalisation increases (Johnson, 1984).

Despite the extensive use of case study research in the social sciences, psychology, sociology, anthropology and economics, it is still often considered a 'weak' research tool due to the subjective nature of a single case study (Eisenhardt 2016). In order to address the issues with case studies and produce robust and valid research, it is important to choose the right case study (Flyvbjerg 2016).

The case studies used in this research aimed to explore the development of a multi-methodological framework that could be used for policy design and analysis in complex environments. It is hoped that the proposed framework will prove useful in environments that consist of multiple organisations with multiple core purposes. In addition, it is theorised that elements of this framework could be applied to an equally complex environment to explore the adaptation of a policy, to support operational decision making, in an existing field rather than identifying new policies.

With this aim, developing a new framework and proving the validity of that framework with a single case study is extremely challenging. Although, the methodologies chosen are considered robust, the use of them together in a single framework may not be. One of the main problems with public policy is the time it takes to ascertain the success or failure of a policy. Despite the ability to use simulation techniques to prove the likelihood of success or failure it takes the practical implementation of the policies designed using the framework to prove or disprove its ability to design an implementable policy. It is for this reason that the focus is solely on policy design and analysis with an emphasis on problem identification and investigation. The validation of the models created using the framework is focussed on their usefulness in

understanding and communicating complexity. Validation will also be made by comparing the resulting models with those developed by researchers in the chosen case study field.

### **6.3 – Case Study 1 - The Mid-Staffordshire Case**

Often referred to as the “worst ever NHS hospital scandal” and “a total system failure”, (Daily Mail, 2011) the highly publicised case of care failures in Mid Staffordshire hospital that led to an independent inquiry chaired by Robert Francis QC, has been selected as a case study to test the validity of applying a System Dynamics approach to add structure to inquiry evidence often presented in the form of inquiry transcripts. Information used to support evidence-based policy making commonly comes in the form of inquiry reports. It is therefore important that the methodologies chosen can simplify this process by mapping causality to identify the issues that triggered the inquiry in the first instance.

On 9 June 2010, the Secretary of State for Health, Andrew Lansley MP, announced a full public inquiry into the role of the commissioning, supervisory and regulatory bodies in the monitoring of Mid Staffordshire Foundation NHS Trust. This inquiry looked into the care provided by Mid Staffordshire NHS Foundation Trust between January 2005 and March 2009. The inquiry (Francis, 2010) was prompted by the identification of higher than expected mortality figures, and evidence of failures in basic patient care.

Key to any research and particularly in areas as complex as health and social care, is the ability to structure information from a wide and diverse range of sources to enable a deeper understanding of the subject area, to

refine a research agenda and to determine causal factors. When those sources include independent inquiry reports and transcripts, government reports and interviews, the task can seem impossible, especially when those same sources are identified because of what has been reported as “systemic failure”. Firstly, there exists a need to fully understand the problematic situation that prompted the inquiry and secondly investigation needs to be undertaken to establish whether evidence of systemic failure truly exists.

Information for the influence diagram depicted in Figure 9 is taken from transcripts of the interviews with patients, patient families, medical staff and management at Mid Staffs Hospital following a routine inspection that revealed an unusually high death rate and poor patient care. This initiated a formal review into ‘what went wrong’ at the hospital. The initial findings revealed a culture of target obsession, bullying, low morale, staff disengagement from management, high levels of absenteeism and failures in patient care (Francis, 2010) which ultimately cost the lives of patients and led to the independent enquiry.

The relationships within an Influence Diagram are depicted with arrows to show the direction of the relationship and with polarity to show the causal nature of the relationship (Schaffernicht, 2007). There are two types of polarity:

- Positive: (+) – where the independent factor and the dependent factor change in the *same* direction
- Negative: (-) – where the independent factor and the dependent factor change in the *opposite* direction

Using information taken directly from the transcripts, factors and relationships in the diagram were identified. This was done by examining statements to identify where causality was described and then decomposing the statements to identify theoretically quantifiable factors. For example, one statement from a nurse read “[The Chief Operating Officer] *was one of the worst for frightening people, coming down and pressuring people, which is why it led to lying...*” The causal link between ‘increased pressure’ and ‘lying’ detailed in this statement is clearly implied. For the statement to be translated to SD, it also needs to be decomposed to identify theoretically quantifiable factors. In this example the ‘*frightening people, coming down and pressuring people*’ is translated to ‘incidences of bullying’ which is a causal factor for ‘incidences of lying’. With 352 witness statements and over a million pages of evidence submitted to the inquiry, the examples used as part of the case study were those used by Francis (2010) to detail the main failings. Though largely based on the evidence itself there are some personal assumptions made by the investigator which means that the resulting models are a reflection of the investigators perspective of the situation.

### **6.3.1 – Loop Analysis**

Identification of the loops (see figure 10) and their subsequent analysis show the impact of one factor in the system on another seemingly unrelated factor through a series of interconnecting factors.

There are two types of loops identifiable within SD; balancing (or negative), which are usually labelled ‘B’ and reinforcement (or positive), which are

usually labelled 'R'; these are labelled in Figure 11. Models containing large numbers of 'R' loops are an indication of a system 'out of control' as is the case with the Mid-Staffordshire investigation, where all the loops identified in figure 10 are reinforcement loops.





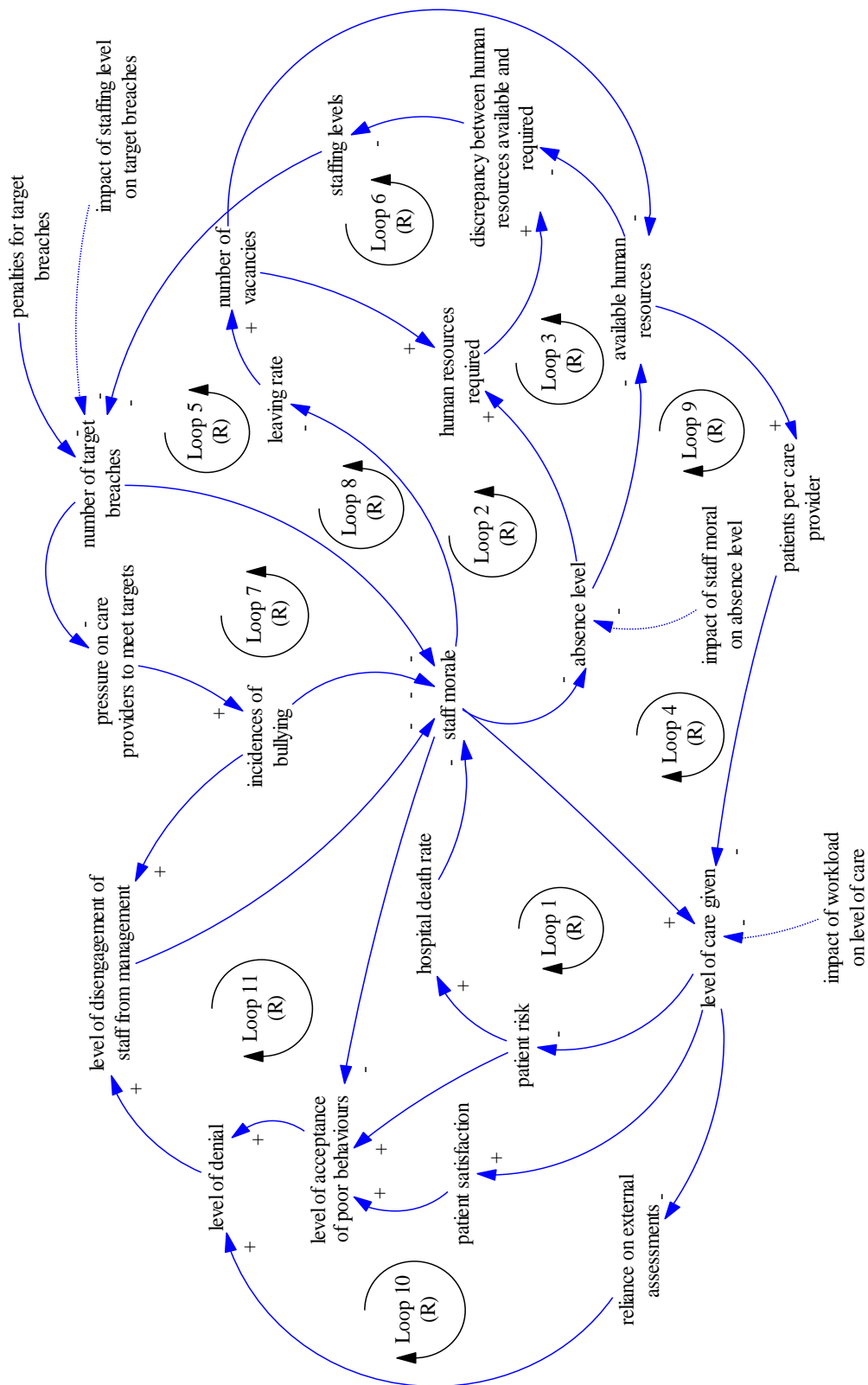


Figure 10: Influence Diagram with Loops Identified

Considering transcript evidence from the inquiry reports, the relationships represented in Figures 11 to 14 become apparent. The large number of reinforcement feedback loops identified in the Mid Staffordshire Influence Diagram strongly suggest a series of ‘vicious or virtuous circles’ where system behaviour unchecked brought catastrophic results.

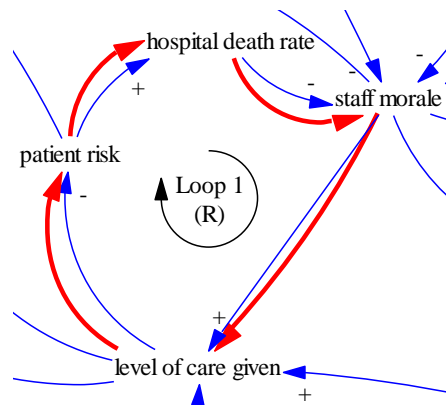


Figure 11: Loop 1 (from figure 10)

**Loop 1** (see fig. 11) – Staff Morale – level of care – patient risk – hospital death rate – staff morale

In this case, as staff morale decreases the level of care decreases which increases the risk to patients which in turn increases the hospital death rate which further decreases staff morale.

The Report (Francis, 2010) states “There was a strong view that there were inadequate numbers of nurses. The doctor, who arrived in A&E in October 2007, did not accept that the problem was due to the quality of the staff, but maintained it was due to a staff shortage and the system within which they were obliged to work, leading them to put their heads down and get on as best they could:

*“Absolutely not about the quality... You have large numbers of staff, you have good ones and bad ones and you try to make the bad ones better. The problem was primarily that there just were not enough staff... Nobody comes to work, very few people come to work to do a bad job and I have never met a nurse who comes to work to do a bad job. The nurses were so under-resourced they were working extra hours, they were desperately moving from place to place to try to give adequate care to patients. If you are in that environment for long enough, what happens is you become immune to the sound of pain. You either become immune to the sound of pain or you walk away. You cannot feel people’s pain, you cannot continue to want to do the best you possibly can when the system says no to you, you can’t do the best you can. And the system in the hospital said no to the nursing staff doing the best they could and to the doctors, but I think the nursing staff probably feel that more acutely in certain respects.” -*

The senior consultant agreed: (Francis, 2010)

*“Since I started in Stafford [in December 2002], I have always been aware that we do not have enough nurses to run the department safely.”*

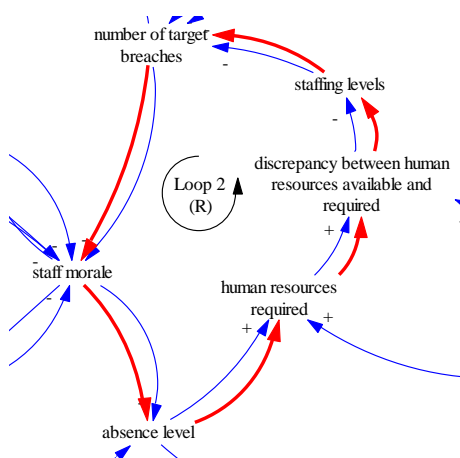


Figure 12: Loop 2 (from figure 10)

**Loop 2** (see fig. 12) – Staff morale – absence level – human resources required – discrepancy between human resources required and available – staffing levels – number of targets breached – staff morale

Again, in this case, as staff morale decreases the absence level increases, which increases the human resources required which increases the discrepancy between the need for and available human resources. This results in a reduction in staffing levels which increases the number of targets breached which further decreases staff morale.

**Loop 7** (see fig.13) – staff morale – absence levels – available human resources – discrepancy between human resources available and required – staffing levels – number of target breaches – pressure on care providers to meet targets – incidences of bullying – staff morale

Low staff morale leads to high absence levels which reduces the available human resources thus increasing the discrepancy between resources required and available which negatively impacts staffing levels leading to an increased number of target breaches, increasing the pressure on care providers to meet targets which increases incidents of bullying further reducing staff morale.

“...this witness described the nature of the externally originated pressure to meet targets in general and financial targets in particular:

*There was a lot of national pressure around making sure that targets were reached and that, along with that, finance was one of those targets, and it was deemed that it was not acceptable and going back to the 2005/2006*

*nationally, it was a very clear directive from the Department of Health/SHA that all organisations had to achieve a financial balance going forward on a recurring basis.”*

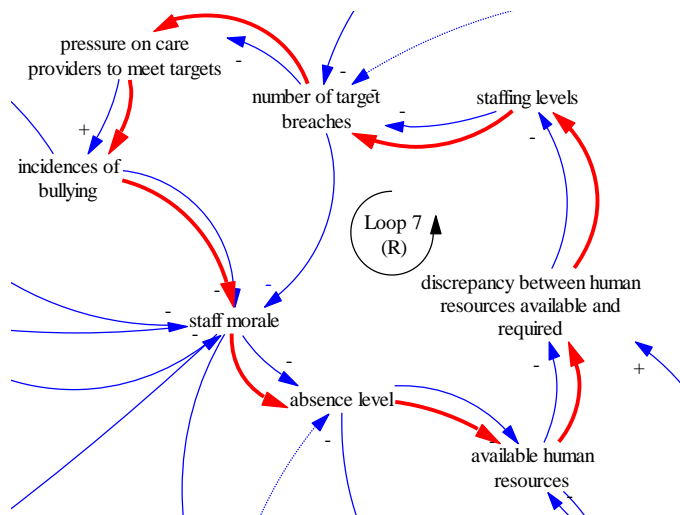


Figure 13: Loop 7 (from figure 10)

A nurse who endeavoured to draw attention to the situation by reporting her concerns told [Francis, QC]:

*“[The Chief Operating Officer] was one of the worst for frightening people, coming down and pressurising people, which is why it led to lying....”*

The pressure to meet the four-hour waiting target from management, and its observed effect on staff, has been considered in the section on culture in the report. (Francis, 2010) This had a highly detrimental effect on the standard of care delivered to patients. One nurse described it in this way:

*“We are under the Nursing and Midwifery Council’s code of conduct... We are given very firm guidelines about what as nurses we should be doing, and it talks of giving obviously care, acting with integrity and providing a standard*

*of care that is second to none really, as far as we are physically able to do so. So to knowingly send a patient to the ward who you, at this point, know needs treatment that you are not giving so that you can whizz them away, is not right.”*

Asked whether, in view of the professional obligations, she had raised the matter she told [Francis, QC]:

*“It was flagged up to managers on numerous occasions that what we were doing wasn’t right. The way round it that I found it for myself personally was I still tried to do those things which, of course, ultimately led to breaches, if I felt that that is what I was going to be doing that, the patient wasn’t going to be achieving that.*

Q: *From your point of view, if you acted as you thought was correct from a professional point of view, but the consequence was that there was a breach of the four-hour target, did that have any implications for you personally?*

A: Yes. Yes.

Q: *In what sense? You mentioned bullying; did you feel bullied yourself?*

A: *Most definitely, and I was in trouble quite often.”*

An emergency physician told [Francis, QC]:

*“The nurses would go into that meeting and they were told in the meeting that [if] there were any breaches to – that is breaches of the four-hour rule – they would be in danger of losing their jobs. On a regular basis, and I mean a*

*number of times per week, when I was on day shifts, I would see nurses coming out of that meeting”*

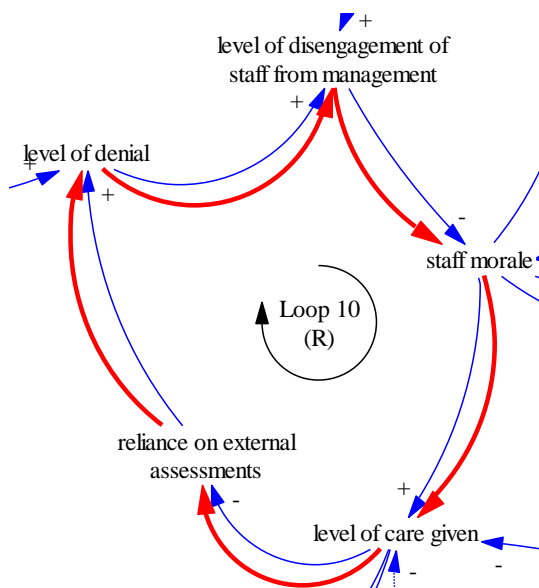


Figure 14: The relationship between care given and level of denial (from figure 10)

**Loop 10** – Staff morale – level of care given – reliance on external assessments – level of denial – level of disengagement from management – staff morale

In this situation as staff morale drops so does the level of care this leads to an increase in the reliance on external assessments to fix issues which increases the level of denial of responsibility which adds to the disengagement of staff from management and which further reduces staff morale.

Ms Brisby, the former Chair of the Trust, was asked about passages in the Trust’s application for FT status which asserted that a high standard of care



was being delivered, and the basis for such assertions. Her answer revealed an emphatic reliance on external assessment (Francis, 2010):

*“The clinical side of the Trust’s activities, and responsibility determining whether that’s up to standard or not, rests with a whole bunch of organisations, most significant of which is the Healthcare Commission. So, it is not as if we were saying our services are fine. It is more there is external assurance of the fact that you have reached the standard in terms of service provision.”*

A clinician, who came to the Trust and A&E as a junior doctor in October 2007 and who is now a consultant there, was disturbed by what he found and had no issue with the HCC findings:

*“When I came to the department, I was more than surprised at the level of care that we regarded as being acceptable for an emergency department.... The way in which we structured our care and in particular the battle-fatigued attitude of the staff did not lead to – it wasn’t conducive for good quality care. It was a case of getting through the day rather than how good can we be today?”*

It seems reasonable to assume that the pressure to achieve targets placed unnecessary pressure on nursing staff which had a serious impact on morale and ultimately on their ability to effectively care for patients. This is a case where the assumption is identified from the modelling and analysis and should arguably have been tested in questioning the witnesses.

The difficulty in a case study of this nature is the temptation to apportion blame, however as the influence diagram shows, the lack of control mechanisms within the system indicate a high level of unpredictability. Control is needed at a systems level in the form of policies, management information and corrective action. The systemic failure evident in this case makes it difficult to determine who, if anyone, is ultimately responsible. As in most organisations a key factor is missing; it is necessary to be aware of issues arising, and the necessary perception depends on assessing appropriate performance measures or encouraging openness in identifying the concerns of staff. For example, the penalties for breaching targets seemed severe with it being referred to as a “sacking offence”. As the following excerpt shows, the sacking offence referred only to board members; however, the perception by medical staff was that the severe penalties referred to them.

There is no doubt that the pressure generated fear, whether justified or not, that failure to meet targets could lead to the sack. The Chief Operating Officer, Karen Morrey confirmed this:

*“Q: And that it was a sacking offence not to get that right?”*

*A: Yes. As were lots of other things, as were not achieving the targets, that was a sacking offence.*

*Q: Is that an environment that makes for a happy ship, do you think?*

*A: I think it makes it for a very highly pressurised, a highly pressured ship. It is absolutely relentless, around the pressures that people are under in that environment.”*

She later explained to [Francis, QC] that the sacking offence referred to Board members.

Even though target breaches could lead to dismissal, this referred only to Board members, the bullying experienced by nursing staff to ensure targets were met, appears to have served only to confirm their belief that the severity of the penalties applied to them.

### **6.3.2 – Summary of Case Study 1**

What is clear from the situation at Mid Staffordshire, is that a deeply embedded structural problem existed. This impacted negatively on care provision and hence resulted in the need for an inquiry. What is not so clear is potential solutions to the existing problem and possible preventative measures needed to ensure it doesn't happen again. By using an approach such as System Dynamics and the core concept of the Information/Action/Consequence paradigm, as discussed in chapter 5, section 5.4.4.4, areas where potential solutions, in the form of policies, are required are identified. Potential policy can be tested through simulation and, as systems theory can help to identify environmental disturbances that would influence the system, the models determine where adjustments can be made to the system to enable the continuation of its purpose. The novel application of System Dynamics in this way, enabled a deeper understanding of the problem situation and identified where action needs to be taken to

address the problem. It also established the context of the problem situation in addition to a mapping of causality. This case study has also helped highlight how SD can be used in the final framework (see figure 11) to establish the context of the policy domain and identify the causality within the problem space.

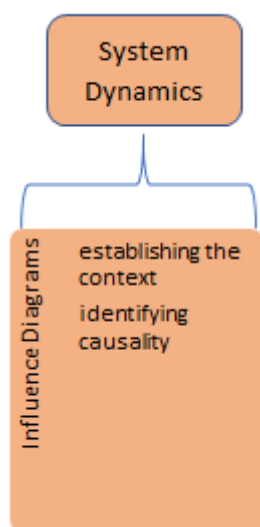


Figure 11: The use of SD in the Framework

## 6.4 – Case Study 2 – The Environment Agency Wales

### 6.4.1 – The Problem

In 2011 the devolution process for the National Environment Agency began and I was approached by The Environment Agency Wales (EAW) to assist them in establishing a 'core purpose' for the new devolved agency. This situation was described as a 'green field' situation meaning they were seeking fresh ideas and a suitable methodology for identifying purpose in addition to identifying problem situations. The aim of the project was to establish if a truly participatory approach using members of the EWA from

different departments resulted in an agreed set of RDs that represented the differing perspectives of the participants.

#### **6.4.2 – Applying SSM**

The project encouraged a truly participatory approach and EAW staff from a variety of departments were invited to a series of workshops, introducing SSM and SD, to allow them to gain an understanding of the methods, tools and techniques being used as well as sharing their thoughts and experiences. Using these workshops along with interviews and mission statements a set of Root Definitions were created. These were edited and adapted until they matched the needs of the EAW. The resulting RDs are below:

*T – A Welsh Government owned system to maintain a natural and built environment for Wales which meets the public's aspirations for an environment conducive to healthy living and desired recreational opportunities and balances the various impacts arising from industrial and domestic activity together with their utilities requirements, climate and other changes, waste and effluent management and those "Acts of God" which occur, or have effect within, the defined area of responsibility of the Environmental Agency of Wales, by providing those services necessary to achieve the desired balance.*

*(Utilities are taken to be gas, electricity, oil, water and other specialist utilities)*

*S1 -- A system to ensure that the physical resources available to Environment Agency Wales match those required to support all the activities undertaken, whilst exploiting relevant developments in technology as a means of enhancing business performance but reflecting appropriate technical standards and the existing infrastructure.*

*S2 -- A system to ensure that the human resource capability available to the Agency, including partners and other contracted staff where appropriate, matches the requirements of all activities through acquisition and disposal, and the operation of coherent programmes of training and education in order to support defined roles, whilst recognising competition for human resources, Welsh Government personnel policy and relevant employment legislation.*

*S3 -- A system to develop and maintain a culture and working environment that allows employees and partners to exercise initiative in the development of policies and working practices that contribute to the greater effectiveness of Environment Agency Wales and facilitate the identification of areas of potential improvement.*

*S4 -- A system to maintain the availability of those channels of communication of appropriate characteristics across the organisational and geographical structure of Environment Agency of Wales and its partners, so that information relevant to Agency and employee-oriented needs can be exchanged as required to achieve clarity of purpose and efficiency of operation, to the satisfaction of relevant stakeholders.*

*S5 – A system to develop, maintain and ensure the appropriate availability of a current knowledge base to support all activities, including that learning derived from the operation of the Agency and the external intelligence required to support all activities, by acquiring, processing and making information available as needed and providing the information required for reporting, but consistent Welsh Government policy and relevant security and commercial sensitivity constraints.*

*L1 -- A system to establish and maintain relationships UK-wide with customer groups and/or their representatives in order to assemble intelligence about needs and expectations so that the provision of the variety of services can be achieved with a performance that meets agreed service standards, while establishing and maintaining relationships with the media and others to promote the service-related policies, required customer attitudes and standards in order to gain public acceptance and support.*

*L2 -- A system to ensure that sufficient funds are available to support the provision of the defined services to the required standards to meet customer and environmental needs and expectations through the acquisition of central*

*funds while adopting derived priorities in the event of any shortfall and constraints on borrowing.*

*L3 -- A system to accommodate, and sponsor where appropriate, European, UK and Welsh Government initiatives, current and potential external events and influences in order to derive responses which are beneficial to the overall security and standing of the Environmental Agency of Wales, while ensuring that the resulting risks are minimised, and appropriate beneficial opportunities are exploited.*

*PMC – An Environmental Agency of Wales owned system to formulate development plans and associated policies to ensure that the Agency recognises and acts upon changes in the economic, and social environment of Wales together with potential changes in the political and business environments so that moves towards a vision related to an overall desired environment for Wales can be achieved through the execution of those plans via a required set of services, an organisational infrastructure and a range of management roles, while recognising constraints arising from available finance, social, ethical, economic and legal considerations.*

The Root Definitions were used to create a single Conceptual Model which was passed to EAW for them to utilise as they saw fit.

As the framework, presented in this thesis, was in the early stages of development, the EWA project was instrumental in helping shape the thinking behind the framework. Figure 12 details how SSM was used to understand the domain, represent multiple perspectives and identify key activities and their dependencies.

The EWA planned to use the SSM Conceptual Model to help map their current processes to the critical activities identified in the conceptual model.

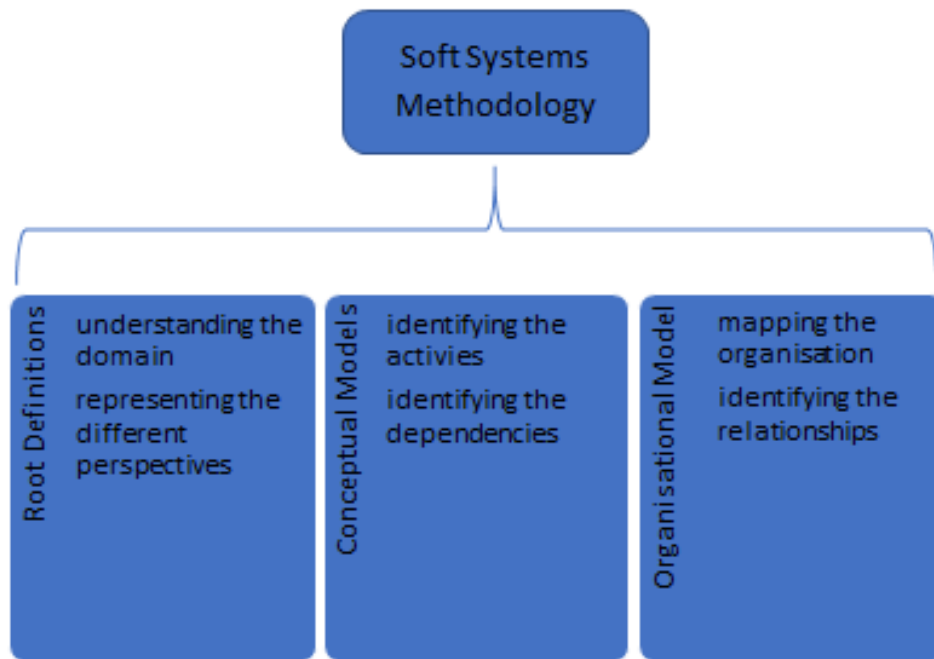


Figure 12: The use of SSM in the Framework

### 6.4.3 – Applying SD

Following the creation and utilisation of the SSM models and diagrams, the EWA were interested in exploring the use of SD to assist in the development of specific policies related to fishing, fly-tipping and PM10 emissions. Their interest lay in the mapping of causality to identify key factors that would indicate the success/failure of a chosen policy action. They were also keen to understand how simulation could help provide evidence to support their policy choices. Although, I provided guidance on the development of SD models for fishing and fly-tipping policies, my main contribution was in the policies related to PM10 emissions. Figure 13 shows how SD was to be used in the development and support of the PM10 emissions policies.



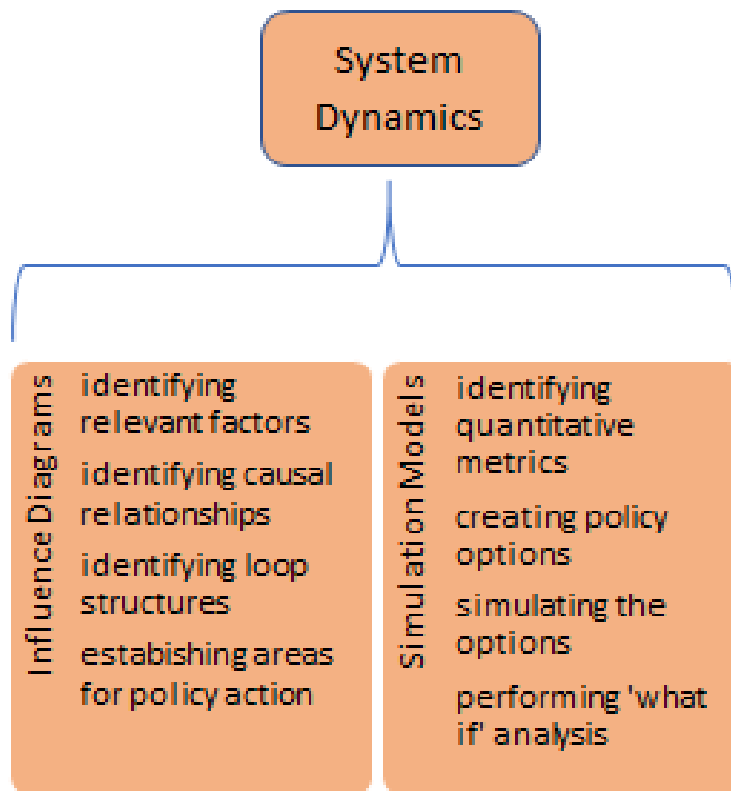


Figure 13: The use of SD to support Policy Decision-Making

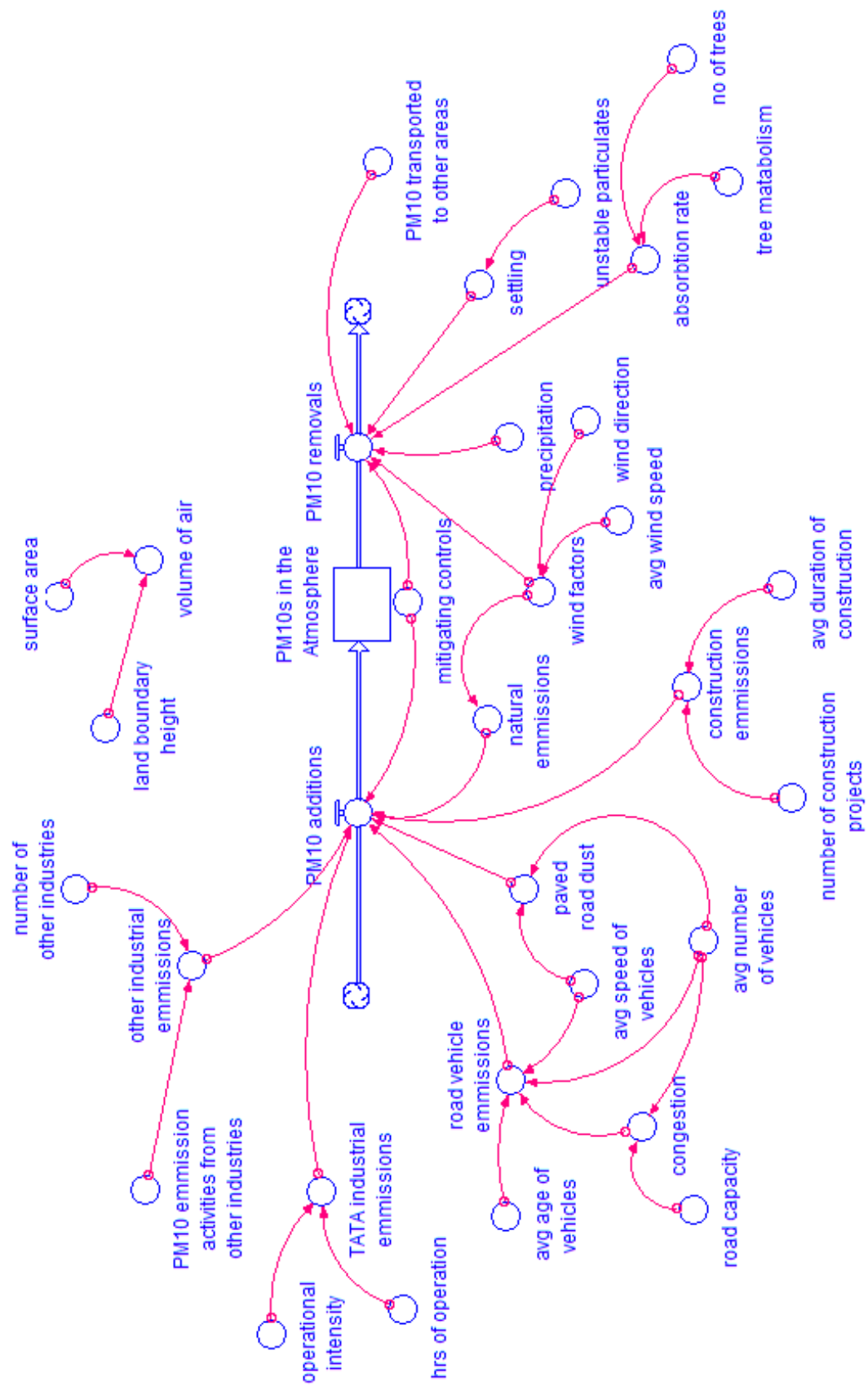


Figure 14: PM10 Policy Model



EWA were interested in looking beyond the PM10 emissions to understand the impact of emissions policies on health, employment and the local economy in the area.

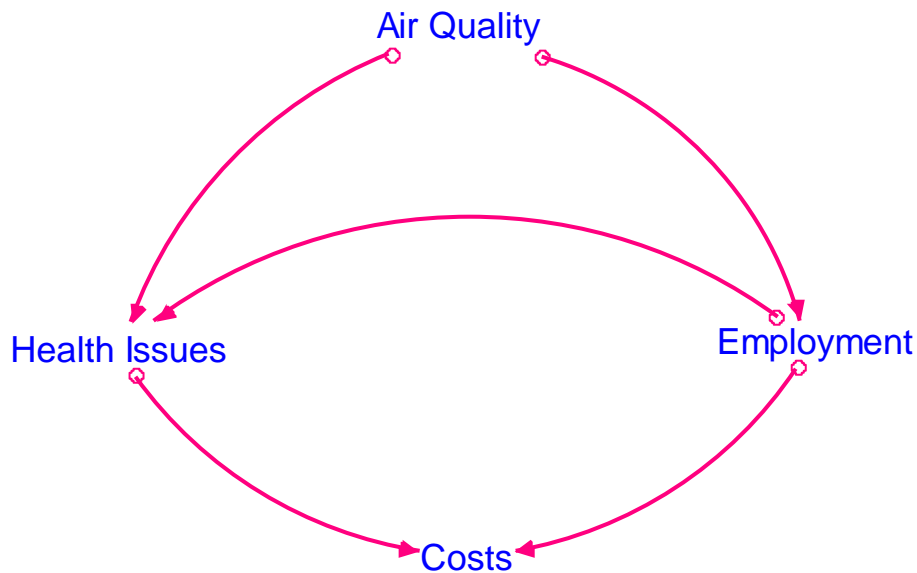


Figure 16: Modular Emissions Diagram

This gave rise to the idea of using multiple models as modules (see figure 16) in a System of Systems Approach. This would allow the users to see the impact of a single policy action in one model on other interlinked models.

#### 6.4.4 – Combining the Techniques

Much of the work completed during the project remained with EWA and access to it is restricted. However, the project helped test the value of the methodologies chosen and provided valuable insights into how policy-makers utilised the models created to provide justification and guidance on policy action. It also helped to establish the usefulness of using a multi-

methodological approach to problem solving using SOSA, SSM and SD.

Figure 17 shows how these were used.

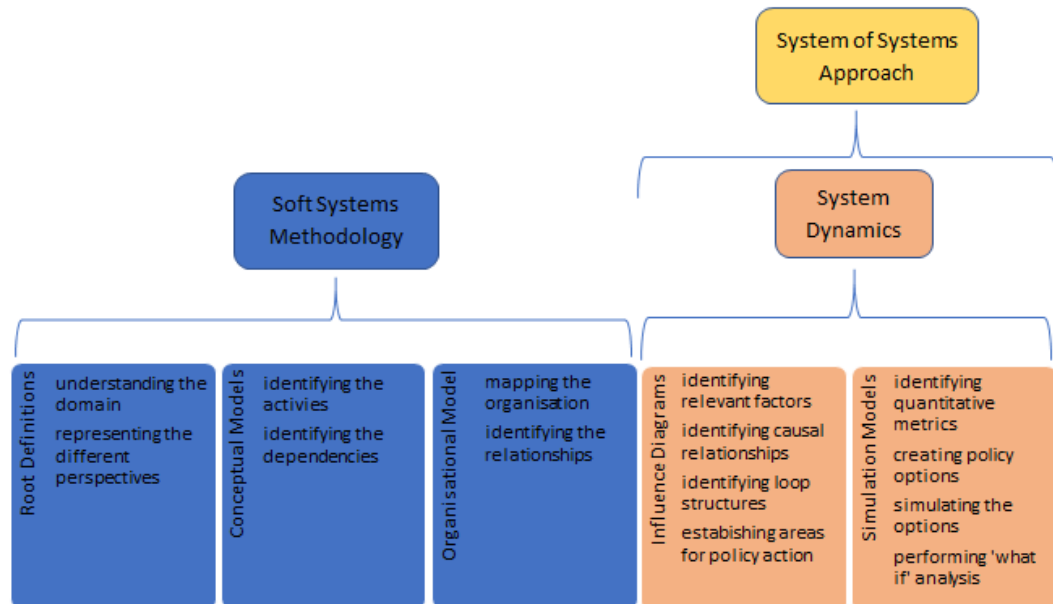


Figure 17: Using SSM, SOSA and SD

## 6.5 – Case Study 3 – Child Protective Social Services

The third case study utilises the groundwork of the previous two case studies to fully develop the new framework. In isolation, the methodologies chosen provide useful insight into a problem domain and help identify key factors, map causality and test potential policies in a simulated environment.

However, the synthesis of these methodologies was not immediately clear, and it can be argued that a 'how' has been provided that supports existing cyclical frameworks rather than establishing an alternative framework. The answer lies in how the methodological choice is applied and if a true synthesis is needed, or indeed can be achieved. Case Study 3 provides the inspiration for synthesising the methodologies and testing that synthesis.

### **6.5.1 – Background to Case Study 3 – Child Protection**

During the last 15 years, child protective services legislation, policy and practice in the UK have undergone significant change triggered by the child deaths that led to major reviews of child protection systems in the UK (Kendrick 2004). The inquiry into the death of Victoria Climbié in 2000 led to massive reform in Child Services following the publication of Lord Laming's inquiry report, and the associated Green Paper "Every Child Matters" in 2003. During the inquiry, inter-agency communication, co-operation, collaboration and information sharing came under heavy criticism: "this was not a failing on the part of one system, it was a failing on the part of every system" (Laming 2003).

The recommendations in Laming's report included over 100 actions aimed at resolving the issues with the 'system' (Laming, 2003) but despite all the political focus, the death of Peter Connolly, known as 'baby P', in 2008 once again highlighted the need for significant improvements in child protection services (Taylor 2008). Following the death of 'baby P', Lord Laming was commissioned to provide a review of his original "Every Child Matters". This second review appeared to call for 'more of the same' and highlighted the inadequacy of the bureaucratic attempts to resolve issues within professional practice (Forrester et.al, 2013).

### **6.5.2 – The Call for an Alternative Approach**

The second Laming review findings were considered evidence that a new approach was needed, with research suggesting that political reform had *intensified* rather than *addressed* issues within Children's Services and

highlighted the need for an alternative approach to research into improving professional practice in child protection (Broadhurst et al, 2009; Calder, 2004; Shaw et al, 2009; White et al, 2010). Traditional approaches to both the investigation into issues, and the solutions created to address them, were clearly not working and this further supported the need for an alternative approach to offer fresh insight through the exploration of new questions and innovative solutions (Munro, 2005). In June 2010, the new UK coalition Government commissioned Professor Eileen Munro to provide an independent review of the Child Protection system in England. The resulting reports focused on a holistic, child centric approach that would move practice away from the significant administrative demands of centralised control to a more localised control with a focus on early intervention.

Whilst it is clear a new, holistic approach to researching in the field of Child Protection is required, and with advantages of a 'systems' approach evident, the review itself misses some key elements. Although a 'whole systems' approach was recommended, the investigation, whilst calling for a move away from bureaucracy, is in itself bounded by the current bureaucratic structure of the system with little attention paid to the socio-economic system within which it resides (Beresford & Rajan-Rankin, 2011). Its child centric approach fails to address the needs of children outside the system and instead focuses on the child as having already entered the system. As a result, the wider systemic failures within education, communities and families that played a significant role in the death of Daniel Pelka in March 2012, are not considered.

The review was delivered in three parts with the final report published in May 2011, and among the recommendations were a removal of statutory timescales, government targets, and national IT systems and regulations, to allow practitioners to design their own services and procedures at a local level. While most of the findings and resulting recommendations are not too dissimilar to those of Laming, the Munro review did not necessarily agree with research in the Social Care Informatics field, that calls for technology as the agreed enabler to improve inter-agency working (Baines et al. 2010), (Gannon-Leary et al. 2006), (Wilson et al. 2011), (Walsh et al. 2012).

One of the biggest differences between the recommendation of the Munro review and the previous Laming inquiry reports, is the move toward decentralised IT systems. The move toward decentralised IT systems presents issues with cohesion, data ontology, and information protocols which makes it difficult to effectively share information among the multiple organisations involved in child protection such as Social Services, Health Authorities, Education Authorities and the police. A study into the recommendations arising from Serious Case Reviews (SCRs) cite information sharing as an issue in over 95% of the SCRs considered (Brandon et al. 2010), which raises cause for serious concern. The idea of locally designed IT solutions would lead to challenges in collaboration, co-operation, and communication across both geographical and organisational boundaries and could potentially lead to key failings in child protection as a child is moved from one authority to another, as was the case with Victoria Climbié.



Four systems approaches are described in the Munro reports, all of which are features of a single methodology; SD. While the use of SD is extremely valuable to understanding and communicating the complexity of child protection, its use within Munro's review appears far too narrow to give a full appreciation of the complexity of multiple organisations working toward a single goal, in this case protecting a child. The use of only one methodology also fails to consider the multiple Weltanschauungen (worldviews) of the system, whereas the use of multiple systems methodologies would allow the problem situation to be fully defined, with multiple worldviews. It would identify the system boundaries, the wider system, and how the system interacts with the wider system as well as identifying the information flows and requirements.

Issues with information sharing will continue while there continues to be little cohesion between the social care community and the informatics community (Rigby et al. 2009), as social services technology partners often report a lack of 'buy-in' from social service providers with culture being cited as the main barrier to inter-agency working and information sharing (Baines et al. 2010). However, social service workers and voluntary sector organisations (VSOs) report that the technological solutions proposed often lack the flexibility needed to accommodate the diverse contributions occurring in the care of a child (Baines et al. 2010) as well as the variety of information needed to support that contribution. Thus, there is a lack of awareness among IT providers of the domain they are addressing. While Munro aims to address some of these issues with a call in her reports for a change of culture, too

little attention is paid to the importance of the role of informatics in child protection and how it should be used to provide social care.

### **6.5.3 – Social Care Informatics**

New research has been called for to address the provision and use of Information Systems in social care to address common issues highlighted in high profile public inquiries and serious case reviews. Defined as “a combination of computer science, information science, and social work ...” (Parker-Oliver, Demiris, 2006) Social Care Informatics is commonly referred to as the missing partner in e-health, (Rigby, Hill, 2010), (Rigby et al. 2009). It is emerging as a field of research with many challenges that are not immediately evident as occurring in the related domain of health informatics (Rigby & Hill 2010). This is due to the substantial differences in the type of information needed and multitude of diverse organisations that can be involved in a single case (Rigby et al. 2009). These organisations often have conflicting priorities, and many have no formal accountability. This, along with the diverse nature of service delivery, completely separates the field from health care, and makes it particularly challenging to investigate the issues, and recommend and implement potential solutions to assist with information exchange, communication and inter-agency working (Rigby et al. 2009), which improve the child care and address the problem.

As a subspecialty Social Care Informatics integrates social science and computer science in the research of the potential of technology, information processes and structures to facilitate the use of data, information and

knowledge to support the decision making in social care roles and the children and families they support (Naccarato 2010).

However, research in this field focuses on its attempts to serve an existing system without fully understanding the 'system' it needs to serve, and whether the current system is 'fit for purpose'. It makes assumptions about needs as it often seeks to find a 'one size fits all' solution. You would not, for example, rent or buy an office block without having first determined how many people you employ. Some aspects of an organisation cannot be defined independently of the organisation itself and that is especially true for Information Systems as the need for information is derived from what an organisation does (and how it is done), and what it wants to control (and what measures of performance it is interested in). Therefore, operational information is needed to support activities and performance information is needed to control them. The resulting Information Systems tend to focus on the parts of child protection work that are easy to formalise and fails to account for the effect this has on professional expertise and whether important information is missing or address how to bring together diverse information (Munro, 2005). They also focus on the needs of a single organisation and fail to consider the working practices of the many other agencies and VSOs that have a significant influence and involvement in child protection (Baines et.al. 2010).

With each new case the same issues are frequently highlighted as contributing factors, for instance Baby 'P', led to a review of "Every Child Matters" (Laming, 2009) and Daniel Pelka, re-enforced the need for improved inter-agency working (Coventry City Council, 2013). These cases

are often highlighted due to the number of agencies involved who, despite the large amount of information available, were still unable to protect the child concerned. Understanding the reasons for the failure is made much more difficult due to the complexity of each individual organisation and their working together to a common goal; that of protecting a child.

#### **6.5.4 – The New Framework and its Application to Child Protection**

Traditional approaches to both the investigation into the issues, and the solutions created to address them within the field of child protection are clearly not working and this supports the argument that an alternative approach is worth consideration and may offer fresh insight through the exploration of new questions and innovative solutions (Munro, 2005). The call for an alternative approach inspired the development of an activity framework (see figure 18) that would enable investigation into the problem area and help establish which methodology would be required at each step to fully understand the issues. This activity diagram would also shape the thinking behind the proposed policy design framework.

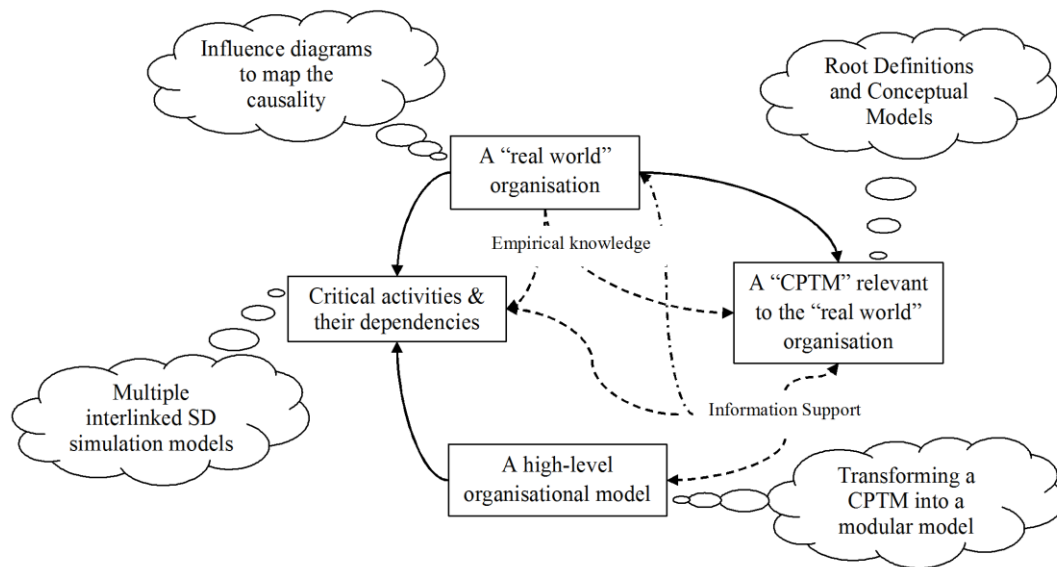


Figure 18: Activity Framework

A participatory approach supports the systems thinking multi-methodological approach that underpins a new framework. Participation was sought to gain an understanding into the many organisations that contribute to child protection as a domain. The participants involved in the initial stages of the proposed framework came from a variety of organisations involved in child protection including child services, health, education, and VSOs. Table 4 details the participants work background, years of experience, and educational background.

Table 4: Participant Information Table

Participant ID	Work Background	Work Role Background	No. of Years' Experience	Highest Educational Award
CS1	Child Protection Services	Social Worker	5+	Master's Degree

CS2	Child Protection Services	Social Worker	12	Master's Degree
CS3	Social Services	Social Work Educator	20+	PhD
CS4	Fostering Services	Social Worker	15	Master's Degree
CS5	Child Protection Services	Social Worker	15	Bachelor Degree
CS6	Family Services	Social Worker	15	Bachelor's Degree
VSO1	Voluntary Sector Organisation	Children's Case Worker	7	Master's Degree
VSO2	Voluntary Sector Organisation	Youth Protection Officer	25	PhD
VSO3	Voluntary Sector Organisation	Children's Case Worker	20	Bachelor Degree
ED1	Education	Head Teacher	20	PhD
ED2	Education	Alternative Provision Tutor	15	Master's Degree
ED3	Education	Children's Oral Health Educator	10	Professional Qualification

Any gaps were addressed through research in child protection including analysis of Government reviews, inquiries, serious case reviews, journals, books and news reports.

The proposed approach would need to address the following 6 steps:

1. Establishing the Context
2. Framing the Problem
3. Identifying Critical Information & Areas for Policy Action
4. Identifying and Developing Alternative Actions
5. Proposing and Testing Action Recommendations
6. Providing an Implementation Plan

In addition, the methodological choice that underpins a new framework needs to cope with the complexity and ambiguity that permeates the policy process whilst also considering the political, social, institutional and economic constraints.

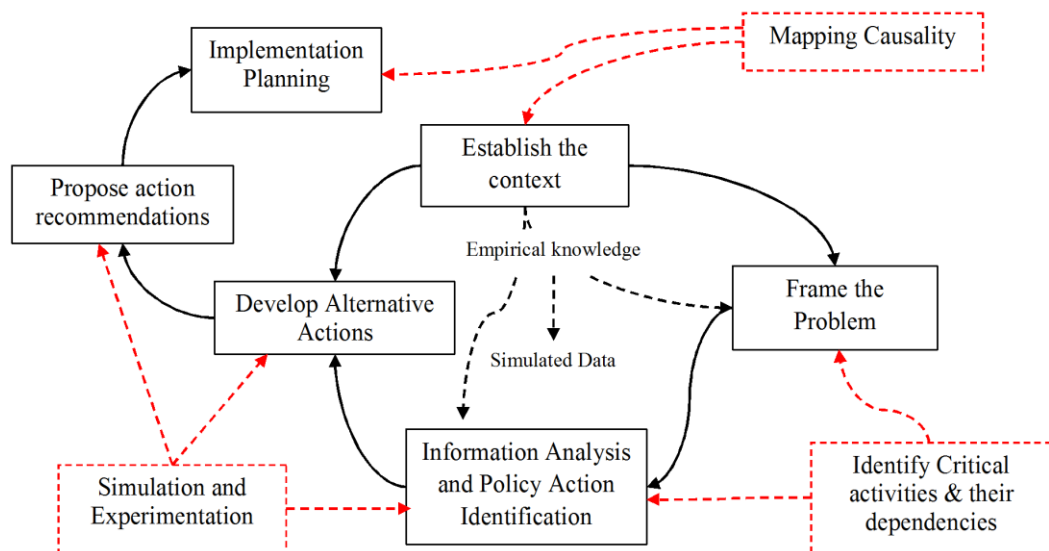


Figure 19: A Proposed Framework for Policy Design & Analysis

The framework depicted in figure 19 was developed and simplified into three themes (red boxes) covering six key steps (black boxes). It starts with 'Establishing the Context'. The three themes, at a very high level are:

- mapping causality
- identifying critical activities and their dependences
- simulation and experimentation

Information plays a key role in the policy design and analysis. When using this framework, the decision makers can identify and understand the empirical domain knowledge and its translation and application as simulated data. In addition, critical factors and related dependency identification would include information needed to measure the efficacy of those factors.

#### **6.5.4.1 – Mapping Causality**

Mapping causality is essential in establishing the context in which the problem situation exists, and that same causality can be used to produce a robust implementation plan, providing the causality mapped is done as objectively as possible. This is by no means an easy task as it requires the model maker to question, and sometimes suspend, their own assumptions. A participatory approach is likely to produce better represented viewpoints with additional research to establish evidence. The mapping of causality will identify patterns of behaviour over time rather than focussing on a single event. It is assumed that 'events' do not simply 'happen' but are a result of multiple chains of causality that create pressure within the system over time. System Dynamics is the most useful methodology for mapping chains of causality and can provide a much-needed structure to the problem situation



context. In addition, SD influence diagrams can provide details of where policy action needs to occur by analysing the feedback 'loop' structure of the diagrams. The concept of feedback in SD is covered in section 5.4.4.4.

#### ***6.5.4.2 – Identifying Critical Activities and Their Dependencies***

Identifying critical activities and their dependencies not only provides a frame of reference for the problem situation but also provides the boundary in which the problem can be viewed. This problem framing focuses on viewing the problem as it is rather than what it appears to be. By providing a well-researched frame of reference developed from understanding the qualitative models detailing causality, key information requirements can be determined.

The identification of critical activities and their dependencies is key to supporting information analysis in that they allow the establishment of evaluation criteria which will be used to test potential policy action.

Evaluation criteria, when applying SSM will take the form of monitoring and performance information linked directly to monitoring and performance activities. Evaluation criteria when identified by SD will take the form of critical success factors and unintended consequences.

#### ***6.5.4.3 – Simulation and Experimentation***

Using SD, qualitative models are transformed into quantitative models for experimentation through simulation. Experimentation can take the form of 'what if' analysis to determine the outcome of several policy options.

Including in the 'what if' analysis is experimentation over several time variances. This establishes if a policy action achieves both (or either) short term and long term success.

The simulation environment needs to consider the complexity of public policies and include the modelling of environmental factors that are essential to the success of a policy action implementation. Such environmental factors should, at the very least, cover the financial effects of implementing a policy action.

#### **6.5.4.4 – Establishing the Context**

To establish the context and frame the problem, influence diagrams were used to map the causality and processes linked to the ‘real world’ organisation that is child protection.

The influence diagrams used were created from face-to-face interviews with a range of participants from varying backgrounds, with varying levels of experience including social workers, case workers, VSOs working in partnership with Child Services, educators, and social work PhD students and researchers (see table 4). Workshops were developed and delivered to the participants to give them a brief overview and deeper understanding of the concepts being used; i.e. System Dynamics.

An Influence Diagram (see figure 20), was created from the article “Problematizing Every Child Matters” (Hoyle 2008), to understand, from the writer’s point of view, some of the issues with social care, specifically Child Services, and to communicate this understanding to the interviewees in order to identify the need for additional information.

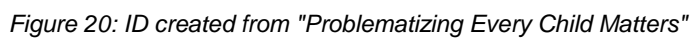
From the sharing of the initial Influence Diagram, gaps in the investigator's knowledge were quickly identified and new models were created from unstructured discussion and interviews (see Figure 21).

Each interviewee had their own opinions and assumptions yet when sharing the completed diagrams consensus was reached as the relationships between elements were recognised.

Though at a high level of abstraction, the model shown in figure 21 already indicates where issues appear and identifies where further information is required to establish a complete and full understanding. This influence diagram represents the investigator's understanding of the social workers' mental models in a way that stimulates discussion.

As questions arise and answers are formed, the models grow, because of discussion and growing understanding, to include additional elements and their relationships, as well as identifying feedback loops that can be analysed (see Figure 22).

Given the complexity of social work services delivery and the need for understanding relationships and interactions, system theory methodologies appear the natural choice for the investigation of this field of informatics where organisations, people, policies and information can be mapped to influence diagrams and simulation models to support decision making at both an individual and policy level.







It is important to highlight the challenges in remaining an objective observer and model creator whilst modelling from someone else's subjective thoughts, assumptions and opinions. However, a key feature of System Dynamics is the ability to not only gain understanding of complexity but also communicate that understanding and its iterative nature lends itself perfectly to gathering qualitative information from a diverse and varied range of sources. This validates SDs use as a problem framing approach.

#### **6.5.4.5 – Framing the Problem**

Although System Dynamics proved useful in providing context and framing the problem, a more robust methodology is required to add structure to the problem situation. SSM, as a PSM, can add this structure with its focus on 'what' the system's purpose is seen to be rather than the 'why' focus of System Dynamics. Having said that, the Influence Diagrams created with the participatory input, proved valuable in the formulation of Root Definitions. In framing the problem, the focus of the SSM models is to fit with the areas the participants felt most needing attention. Figure 23 shows the graphical representation of the elements that were identified by the participants as key considerations for modelling.

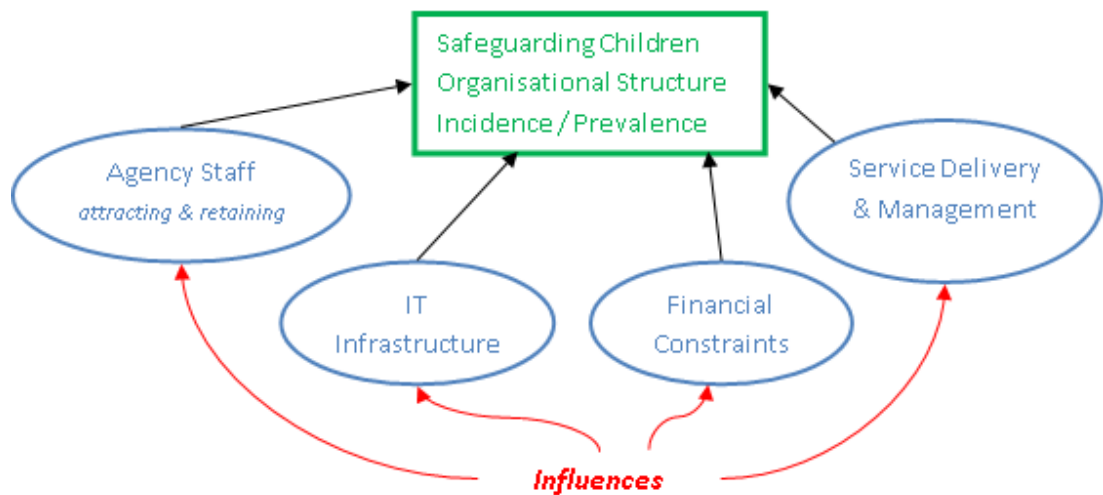


Figure 23: Diagram Detailing the Focus for Developing the SSM Models

The concept of systems, in the context of policy making, is discussed in chapter 3 (section 3.3.4) with specific systems theory methodologies discussed in chapter 5 but to fully understand and communicate the methodologies used in framing the problem, a further discussion of Systems Theory in the context of child protection is required here.

The concept of systems discussed in this thesis embraces Checkland's view that a 'human activity system' exhibits all the characteristics of a system, but that the purpose reflects participants' *Weltanschauungen*; all the 'actors' in a 'human activity system' are undertaking 'purposeful activity', but there exists a range of purposes. If this thinking is applied, it leads to the consideration of the 'purpose' of the system. This suggests that the system has been 'designed' to achieve its purpose, and that this design incorporates the *control activities* that are necessary to ensure it continues to achieve its purpose in the face of a changing 'environment'. Note that the term 'environment' is being used in the systemic context; that is, everything



outside the system's boundary, which the system cannot control but must take account of. Examples of "environmental factors" could include changing legislative constraints. Taking this view, assembling an SoS (System of Systems) means taking systems constructed for one purpose and seeking to achieve some new (arguably, *emergent*) purpose.

When applying this concept to Child Protection it means considering the many differing organisations involved in service delivery (with each, arguably, seeking to achieve their own particular purpose) but amalgamating them into a System of Systems with a focus on a (potentially different or even incompatible) singular purpose; i.e. protecting children. In doing this, care must be taken to consider the following problems:

- Not all activities in each constituent system may be required for the achievement of the new, overarching purpose.
- The constituent systems' control mechanisms (measures and targets) may not be appropriate to the new purpose. Some activities (logically) necessary for achieving the "new" purpose may not be undertaken by any of the constituent systems. For example, appropriate internal "linking" activities may not exist.

While the first issue is of little practical import, it creates waste and unnecessary work, the latter has the potential to be a critical failing. Ineffective activities are simply a waste of resources, but a lack of control activities implies a 'system' (or 'suprasystem') that does not have the mechanisms to ensure continued achievement of the overall purpose.

To avoid such issues, the identity of the 'suprasystem' must take place to clearly define its purpose, disregard wasteful activities and establish control mechanisms.

In framing the problem of child protection SSM was used to understand the problem situation and clearly define organisational purpose through the formulation of Root Definitions (RDs). These were then used to create a Conceptual Model (CM) where all activities and their dependencies are logically derived as a means of achieving purpose. This allows for flexibility in deciding 'how' purpose is achieved enabling innovative processes that can easily adapt to a changing political and environmental landscape.

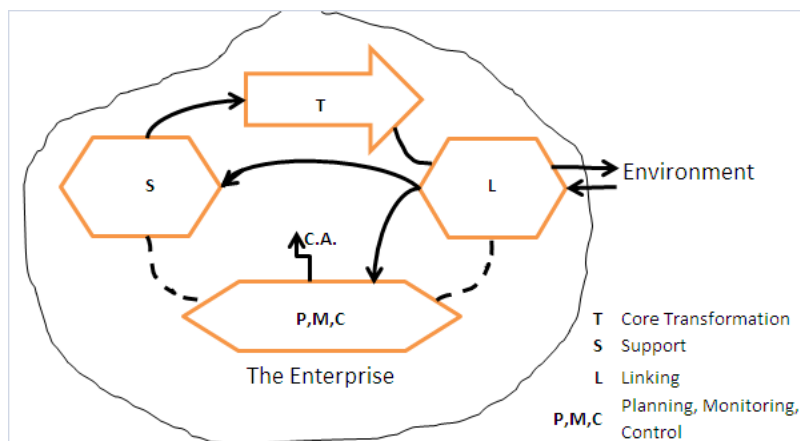


Figure 24: Enterprise Model as taken from B. Wilson (2002)

The RDs developed for the case of child protection follow and take the form of Consensus Primary Task Models (CPTM), a concept developed by Wilson (2001). CPTM uses the 'Enterprise Model' (see figure 18) to allow various stake-holders, guided by the analyst, to work together to formulate Root Definitions and Conceptual Models to cover each aspect of the organisation.

This establishes how the organisation is viewed from multiple perspectives.

This is an iterative process where RDs and CMs are developed and modified until a consensus model is agreed which can then facilitate real world changes.

#### **6.5.4.5.1 – The Root Definitions**

The following Root Definitions were developed using a participatory approach and with the influence diagrams detailed in section 6.5.4.4. In addition, domain specific research was conducted to further inform the construction of the Root Definitions. An iterative process is required to ensure the Root Definitions capture all the necessary perspectives. The Root Definitions detailed are labelled as follows:

- T – to represent the core transformation. There should only be one ‘T’ Root Definition to detail the agreed core purpose as those participating perceive it to be.
- S – to represent the ‘support’ systems. These provide the alternative perspectives from various actors within the system, detailing what they perceive the organisation to be and as such there should be multiple Root Definition to ensure all perspectives are captured.
- L – to represent the ‘linking’ systems. These provide the alternative perspectives from both actors within the systems and observers of the system, detailing what they perceive the organisation to be. As with ‘S’, there should be multiple Root Definitions.

- P.M.C – to represent the overall planning, monitoring and control activities of the system as agreed by all participants. Much like the ‘T’ there should only be one of this type of Root Definition.

As the Root Definitions are detailed, explanations as to how they were formed will be provided. The first, and arguably, the most important, is the RD detailing the core purpose. This was developed using the existing frameworks for the provision of child protection services and agreed upon by the practitioners and researchers.

*T - A system operated by child protection teams, to ensure the physical, mental and moral well-being of school-age children in Wales who have been identified as being potentially at risk, through the provision of child protection services which make and act upon timely and appropriate decisions about how to react to, or pre-empt, events or justified suspicions, while complying with relevant legal constraints and reflecting the need to justify and record all decisions, and ensuring that the rights of the individual and close family members are maintained, and that the individual's wishes are accommodated where safe and appropriate to do so.*

The following two Root Definitions have more generic features and are applicable to most organisations, as the effective and efficient management of support services are essential in the achievement of that organisations purpose.

*S1 – A system to ensure the physical resources available to child protection teams, including relevant third parties match those required to support all activities including the exploitation of technological developments as a means of enhancing performance.*

*S2 – A system to ensure the human resources available to child protection teams, including relevant third parties match those required to complete all activities through the acquisition, disposal and development of staff through appropriate learning programmes that support the defined roles whilst adhering to relevant employment legislation.*

The issues of organisational culture, as detailed in S3, continue to be discussed by researchers in both social sciences and management science. The rationale for its inclusion in this set of Root Definition was in response to the Welsh Assembly Government's report into child services published in 2011 (Welsh Assembly Government, 2011).

*S3 – A system to develop and maintain a culture and working environment that allows relevant personnel and other associated bodies to exercise initiative in the development of policies and working practices that contribute to the greater effectiveness of child protection, the freedom to challenge current policies and processes, and facilitate the identification of areas of potential improvement.*

Root Definitions S4 and S5 consider communication and knowledge base development for all those involved in child protection. Many of the SCRs and inquiries have criticised those involved for the inability to effectively communicate as they work across agency boundaries. Not only do channels of communication need to be considered, but also consideration needs to be given to the information required to make effective, appropriate and justifiable decisions.

*S4 – A system to maintain the availability of those channels of communication of appropriate characteristics across the organisational and geographical structure of the child protection teams and other associated bodies, so that information relevant to a child's needs can be exchanged as required to facilitate appropriate decision making, to achieve clarity of purpose and efficiency of operation, to the satisfaction of relevant stakeholders.*

*S5 – A system to develop, maintain and ensure the availability of a current knowledge base to support all activities, including that learning derived from the operation of the Child Services and the external intelligence required to support all activities, by acquiring, processing and making information available as needed and providing the information required for reporting, and decision making but consistent with Welsh Government policy and relevant security and commercial sensitivity constraints.*

S6 considers the financial situation and, again, is applicable to most organisations. It is also particularly useful in establishing key activities to monitor and control the financial position that can be used for planning the implementation of policy action.

*S6 – A system to ensure that sufficient funds are available to support the provision of the defined services to the required standards to meet client needs and expectations through the acquisition of central funds while adopting derived priorities in the event of any shortfall and constraints on borrowing.*

Key to the work of those involved in child protection is the establishment, and maintenance of relationships with third party organisations involved in child protection, as detailed in L1. These include VSOs, educators, health professional and the police.

*L1 – A system to establish and maintain relationships with appropriate third party organisations working in collaboration with the Local Authority in the safeguarding of children as well as stakeholders in order to ensure they remain informed of existing policies and skills requirements and to assemble intelligence about needs and expectations so that the provision of the variety of services can be achieved with a performance that meets agreed service standards, while establishing and maintaining relationships with the media and others to promote the service-related policies and standards in order to gain public acceptance and support.*

L2 considers the power to effectively adjust to changes in political landscape as well as participating in the development of those changes. The experience of those involved in the organisation is often sought as evidence to inform future policy, further justifying its inclusion.

*L2 – A system to allow child protection teams and other associated bodies to promote desired changes and respond to current and potential changes in the policies of the Local Authority and relevant legislation related to child protection based on UK, EC and Welsh Government initiatives, current and potential external events and influences whilst ensuring beneficial opportunities are exploited and resulting risks are minimised.*

A late addition to this particular set of Root Definitions, L3 accepts the need to attempt to deter and prevent incidents of child abuse. After discussion with those involved in child protection it became clear that there existed concerns that child services could be viewed as a “bad” thing and thus prevent them from providing the essential services to facilitate needs. A balance between child services acting as a deterrent and being approachable was requested and agreed.

*L3 – A system to allow child protection teams and other associated bodies to influence and shape social environment by acting as a deterrent against child abuse whilst remaining approachable to families in need.*



Planning, monitoring and control is essential to all organisations and details the constraints which organisations responsible for child protection need to consider.

*PMC – A Local Authority owned system to formulate development plans and associated policies to ensure that the child protection services and associated bodies recognise and reacts to changes in the legal, economic, and social environment of Wales together with potential changes in the political environment so that moves towards a vision related to an overall desired deployment of social services for Wales can be achieved through the execution of those plans via a required set of processes, an appropriate organisational infrastructure and a range of management roles, while recognising constraints arising from available finance, social, ethical, economic and legal considerations.*

It is important to note that the language used within the Root Definitions was a true representation of relevance to those involved in child protection. In addition to ensuring agreement as to the content and relevance, the Root Definitions also need to be validated for their construction. This was done through consultation with experienced SSM practitioners and Professor Brian Wilson who created this methodology.

#### **6.5.4.5.2 – The Conceptual Models**

Except for 'T' and 'PMC', the initial conceptual models were developed for each Root Definition separately by applying a System of Systems Approach.

This was to promote learning and structure thinking. It also proved useful in communicating the concepts of SSM to those participating in the development, where the presentation of a large complicated Conceptual Model with hundreds of activities would prove daunting. Examples of these models are shown in figures 25, 26 and 27. A more complete set of the smaller Conceptual Models can be found in Appendix A.

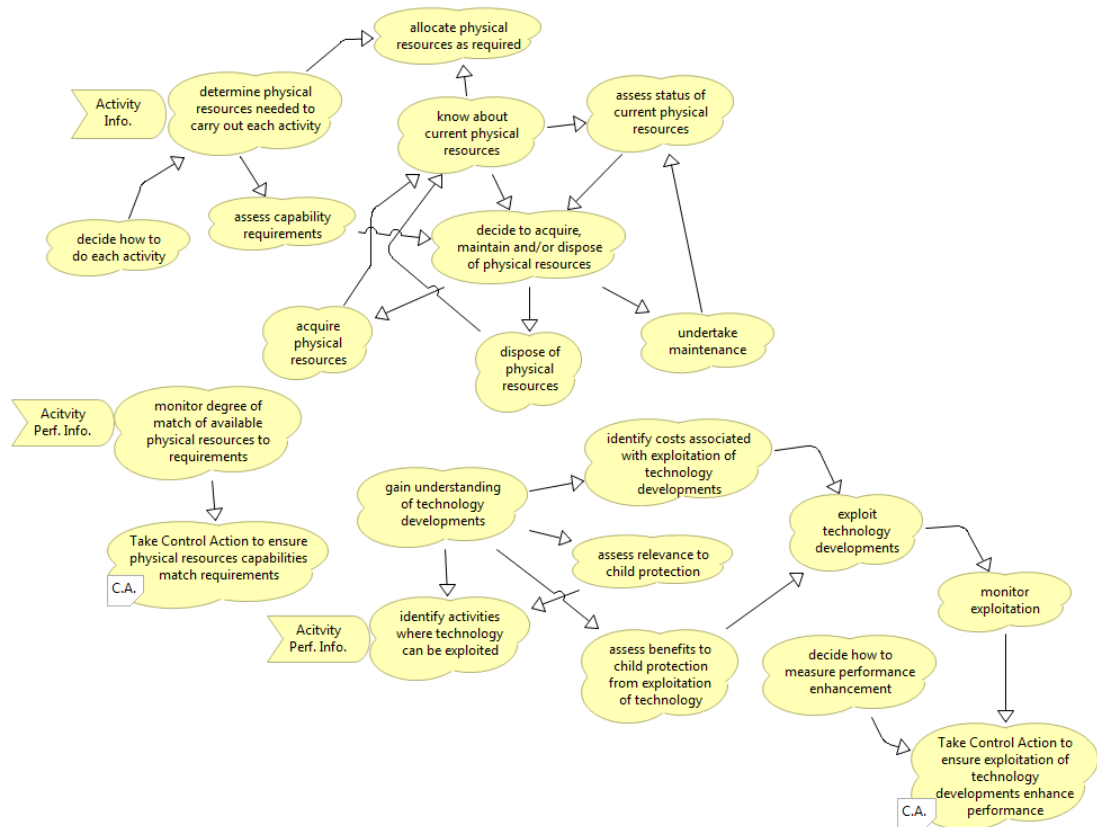


Figure 25: S1 Conceptual Model

Figure 25 is the Conceptual Model resulting from Root Definition 'S1' which considers the physical resources needed to achieve the overall organisational purpose. It includes critical activities that cover how the use of technology has the potential to enhance performance. It also includes critical activities that provide monitoring and control of all other activities linked with the use of physical resources and technology in achieving purpose.

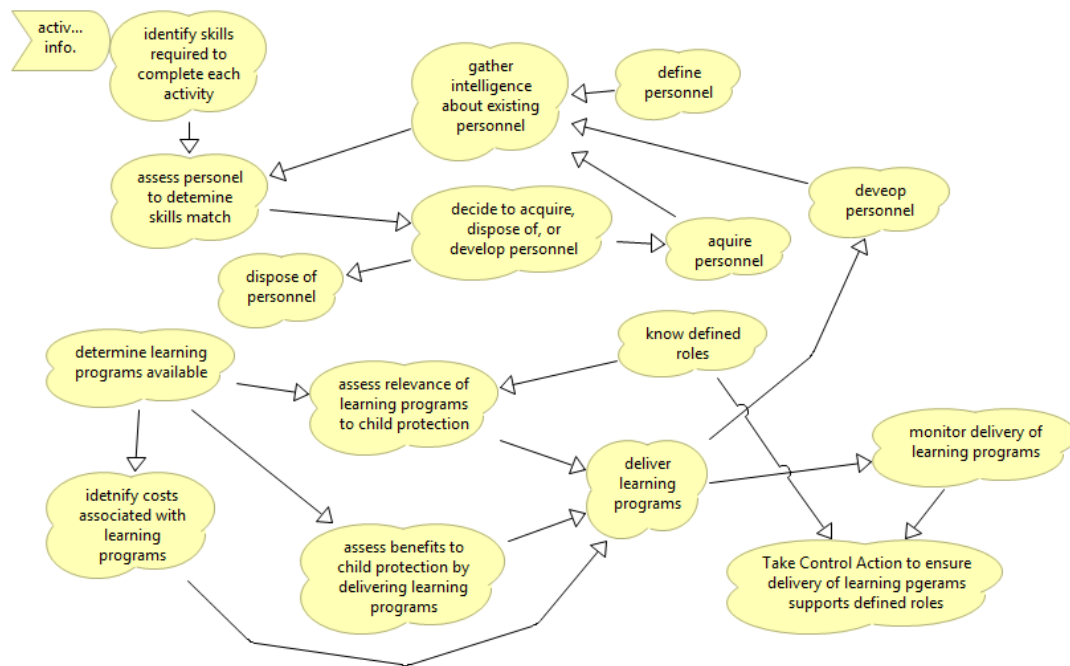


Figure 26: S2 Conceptual Model

Figure 26 is the Conceptual Model resulting from Root Definition 'S2' which considers the human resources needed to achieve the overall organisational purpose. The critical activities detailed in this model cover all aspects of human resource management including; the definition of roles, training and provision of monitoring and control activities, linked with the use of human resources in achieving purpose.

Figure 27 is the Conceptual Model resulting from Root Definition 'S5' which considers the development and maintenance of a comprehensive knowledge base that can be used for reporting, and support decision making. In addition, it considers the data needed to achieve the overall organisational purpose. It includes critical activities that cover how the use of technology has the potential to enhance performance. It also includes critical activities

that provide monitoring and control of all other activities linked with the use of physical resources and technology in achieving purpose.

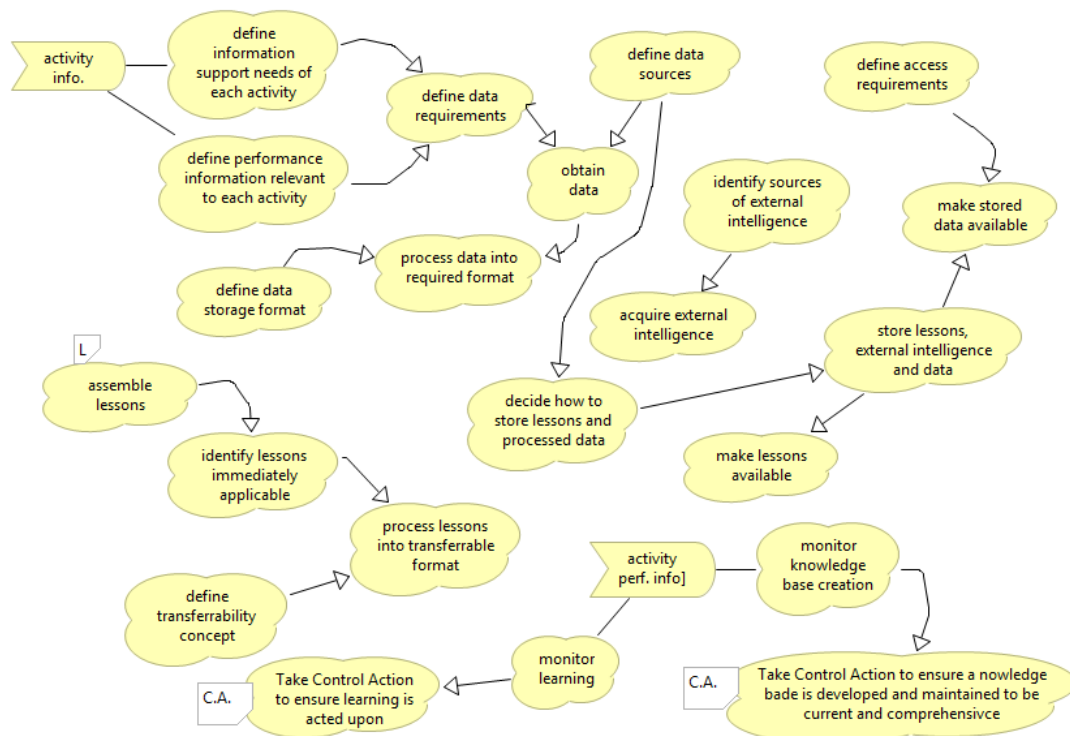


Figure 27: S5 Conceptual Model

A large comprehensive Conceptual Model depicting all the Root Definitions can be found in Appendix B.

The development of Conceptual Models, whether as a set of models depicting a System of Systems Approach, or as one large model, encompasses all the critical activities required to achieve the defined purpose. Validation of models is based on whether they are defensible. With model activities logically derived from an agreed set of Root Definitions, and therefore necessary to achieve purpose, it is considered fully defensible.

#### 6.5.4.5.3 – The Organisational Model

Although the Conceptual Models were created as single systems before being combined into a single larger model, this separation is not necessarily suited to creation of an organisational model. Each of the smaller models can be seen as an obvious way to break down the larger model into organisational departments or section. However, this does not match the existing organisational structure *or* the desired organisational structure.

It is at this point that the methodologies can be truly synthesised as the organisation model developed using SSM can also form the high-level modular diagram of SD. Each of the small SD models then becomes a system in its own right whilst still remaining part of the larger system thus creating a System of Systems Approach that synthesises SSM and SD.

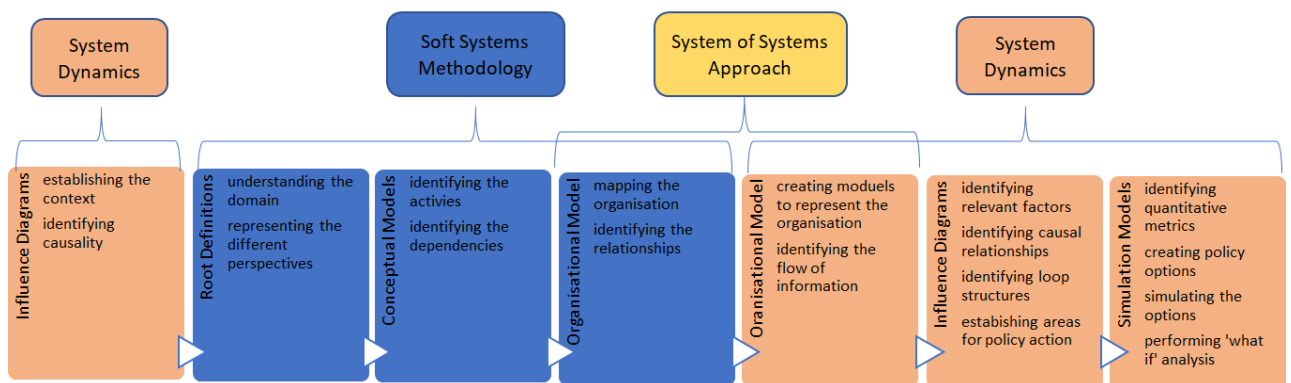


Figure 28: The Synthesising of SSM and SD

Figure 28 details how the methodologies were used in the development and application of the new framework.

The modular diagram allows causality to be mapped according to organisation structure. It becomes very clear where one department, or

section, of the organisation links to another. Figure 29 shows the organisational model resulting from the larger Conceptual Model. The organisational model has two types; a qualitative and a quantitative. Each module in the qualitative organisational model contains a System Dynamics influence diagram and in the quantitative, a simulation model. The lower level models, be they qualitative or quantitative, model the department in its own right but have clear connections with other departments (see figure 30). This results in a total of 42 models. Due to time constraints and the need to limit the scope of the thesis not all 42 models have been completed. Instead, focus is on a small number of models that effectively demonstrate the usefulness of the policy design and analysis framework.

The example shown in figure 30 represents the Human Resource (HR) Management Influence Diagram with its clear links to the Case Management Diagram. This makes the impact of changes, made in the either Case Management or HR Management, clearly visible.

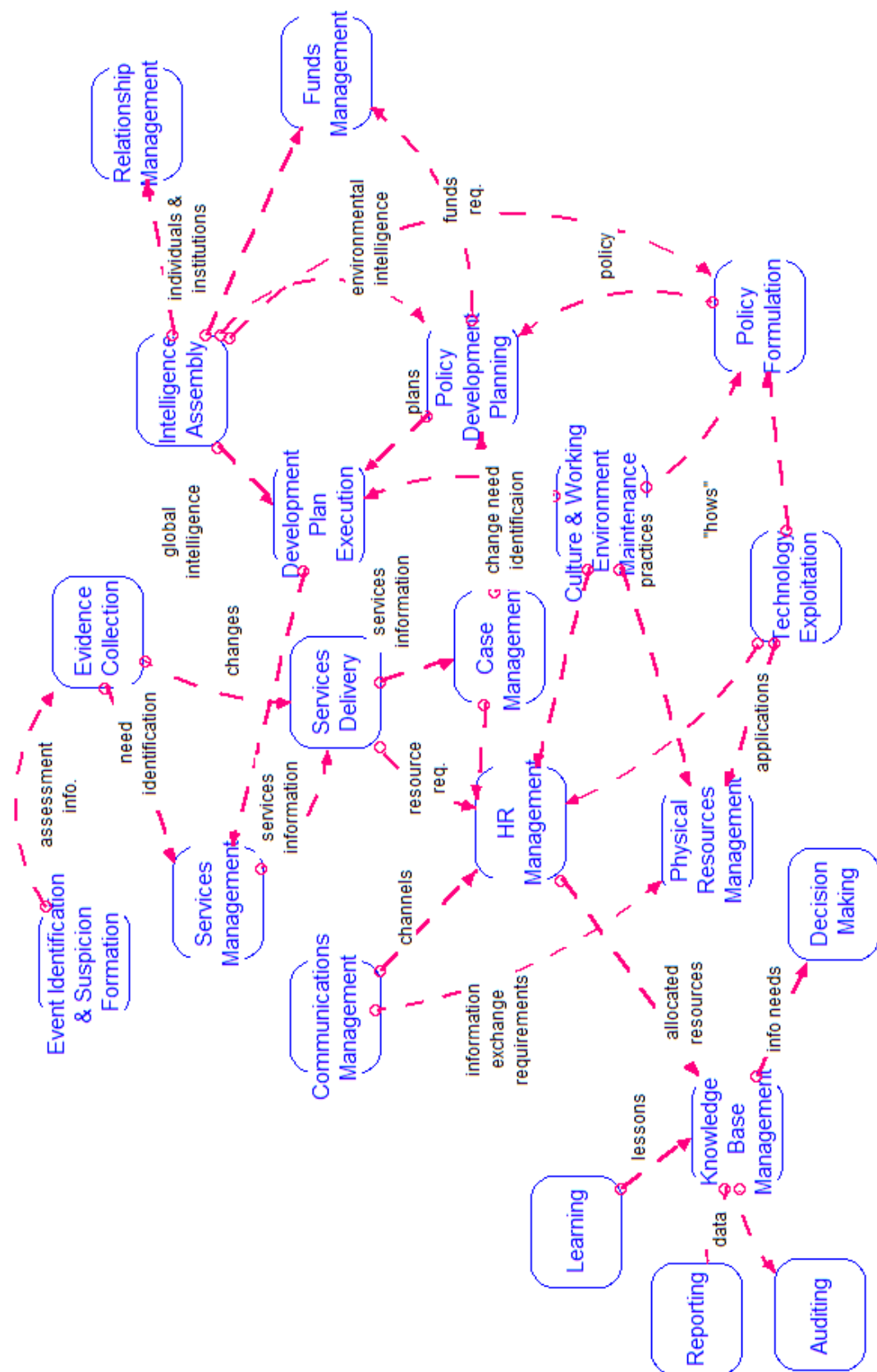


Figure 29: Child Protection Organisational Model





#### **6.5.4.6 – Identifying Information Needs and Information Analysis**

The formation of models, as context is established, and problems are framed, requires attention to be paid to the information used, both in the creation of the models and generated by the models. With SSM, information generated can be analysed using information tables. However, this is most useful when performing comparative analysis between the desired state of the 'system' and the existing state of the 'system'. However, it is not unusual to review the model for its usefulness in understanding and communicating complexity and *not* proceed with a tabular analysis. Especially when completing a tabular analysis would not add any additional value to the overall body of work. In the case of this thesis, the conceptual models were used to inform the creation of Influence Diagrams and Simulation Models. Thus, the completion of a tabular analysis was not necessary. Figure 31 gives an example where the conceptual models were used to inform the creation of the Influence Diagram.

When creating the Influence Diagrams to map causality it is important to note that not all the information contained within the diagrams will be easily 'measurable', i.e. the metrics used to 'measure' the factors are not clear. However, all factors within an Influence Diagram should be theoretically quantifiable. As the value of System Dynamics is understanding the behaviour of the system over time, the inability to find accurate numerical figures for a factor is not considered an issue (Peterson, 2003). This means that 'soft' variables such as motivation, morale, stress, commitment, which all have an impact on productivity can be included. Measurement within the model could consist of a scale and produce numbers that appear



to a need to be able to categorise the information and data needed to support the creation of simulation models based on Influence Diagrams.

Using the HR Management model as an example (see figure 32), an attempt has been made to categorise the information and data used in it.

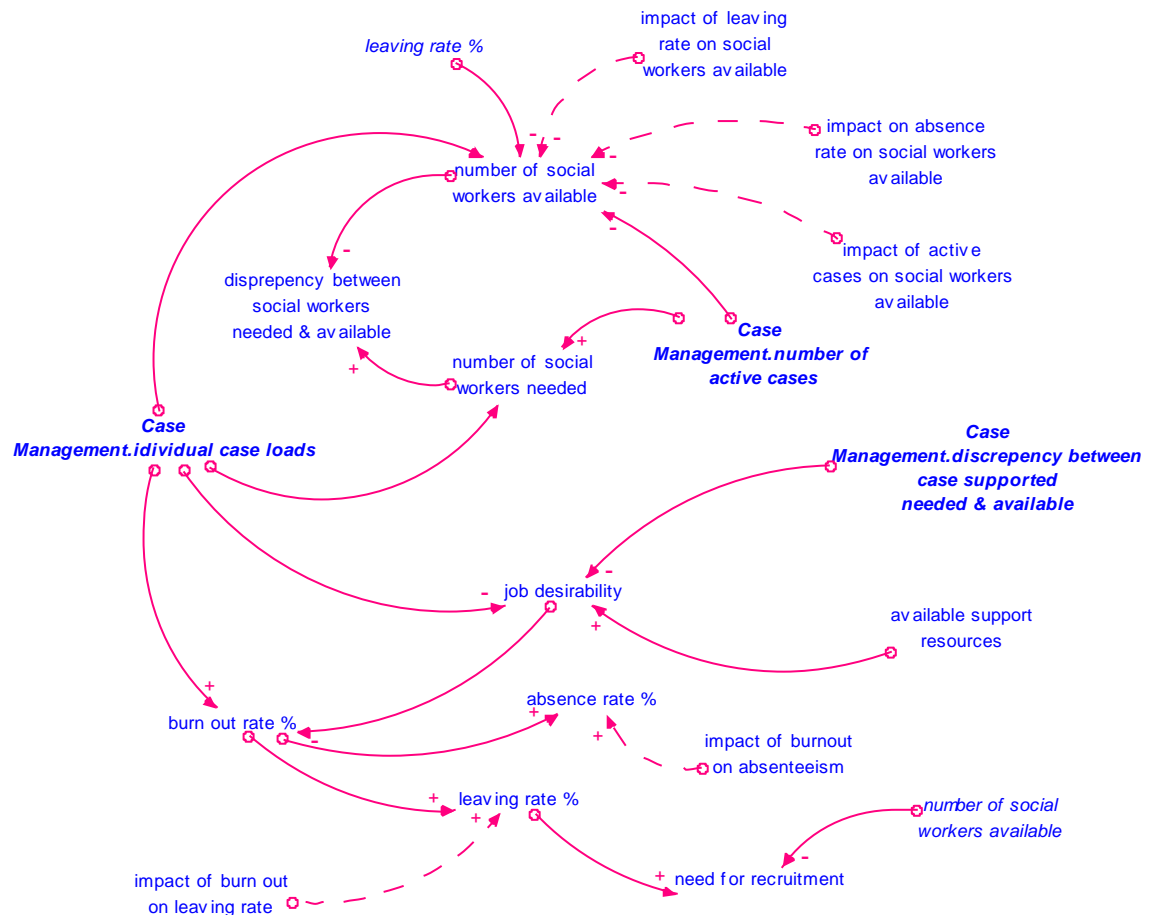


Figure 32: HR Management Influence Diagram

The information in the model is broken down as follows:

- Influence: Number of Social Workers Available:
  - Total Social Workers
  - Number of social workers on leave
    - Annual Leave figures
    - Sick Absence figures

- Other Absence figures
  - Average cases per social worker
  - Total active cases
- Influence: Number of Social Workers Needed:
  - Number of active cases
  - Number of new cases
  - Average number of cases per social worker
- Influence: Discrepancy between Social Workers Needed and Available:
  - Total Social Workers Needed
  - Total Social Workers Available
- Influence: Leaving Rate:
  - Number of Social Workers Retiring
  - Number of Social Workers Resigning
  - Number of Social Worker Dismissals
- Influence: Absence Rate:
  - Annual Leave Rate
  - Sick Absence Rate
  - Other Absence Rate
- Influence: Burnout Rate:
  - Absence
  - Leaving
  - Caseload
- Influence: Need for Recruitment:
  - Acceptable Discrepancy Level

- Burnout Rate
- Absence Rate
- Leaving Rate
- Influence: Average Caseload per Social Worker
  - Average number of cases per social worker
  - Complexity of cases per social worker
  - Risk associated with cases
  - Travel associated with cases
  - Number of agencies involved in cases
  - Total workload points
- Influence: Available Support Resources
  - Total number of support workers
  - Average hours of support per social worker
  - Average hours of support per case
- Influence: Number of Administrative Hours
  - Number of cases
  - Average number of cases per social worker
  - Complexity of cases
  - Number of agencies involved
  - Need for Information
  - Total information sources

Once an understanding of the information and how it is broken down is reached, there exists a need to be able to categorise that information and map the information to the relevant categories. The information required to support the models was categorised as follows:

## Information Categories:

- a) Information needed
  - Information available
    - Information available in needed format
    - Information available not in needed format
    - Implied information
    - Explicit information
    - Useful information
    - Non-useful information
  - Information not available
    - Information generated
    - Information exists
    - Information doesn't exist

A diagram (see figure 33) was created to simplify the concept of the information categorisation and aid the mapping of the model information into the relevant category. Figure 34 shows how information from the model was then mapped into those categories. The information source, in this case, was from the National Statistics Office. However, as this framework is applied in other problem domains, it may be possible to obtain the information from other sources.

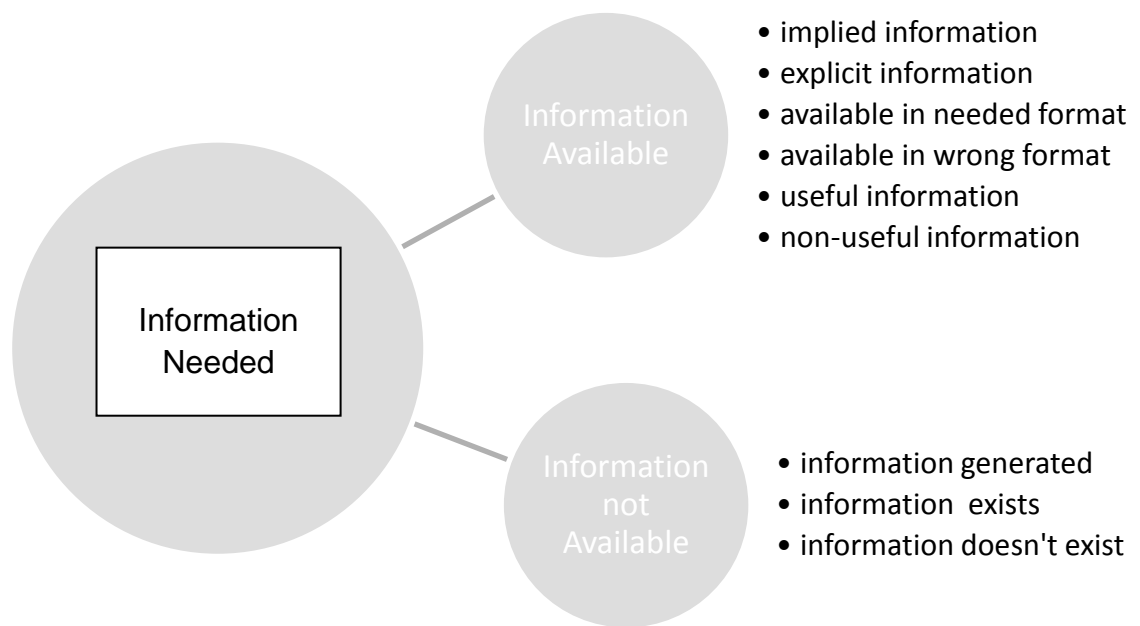


Figure 33: Diagram of Information Categorisation

Creation of System Dynamic models, be they Influence Diagrams or Simulations, is an iterative process and by mapping the information, as shown in figure 34, it can become clear where previously unconsidered factors need to be included. This may be due to the data collections used as a source of information for the models to identify both implied and explicit information. For example, the model shown in figure 32 does not include agency workers used to fill vacancies, or the total number of vacancies left unfilled. It assumes the 'Total Number of Social Workers Needed' is based on the number of vacancies rather than considering the number of cases each social worker should be handling at any one time. Whereas, a more realistic mapping of causality would imply that the number of social workers needed should be based purely on the number of active cases.

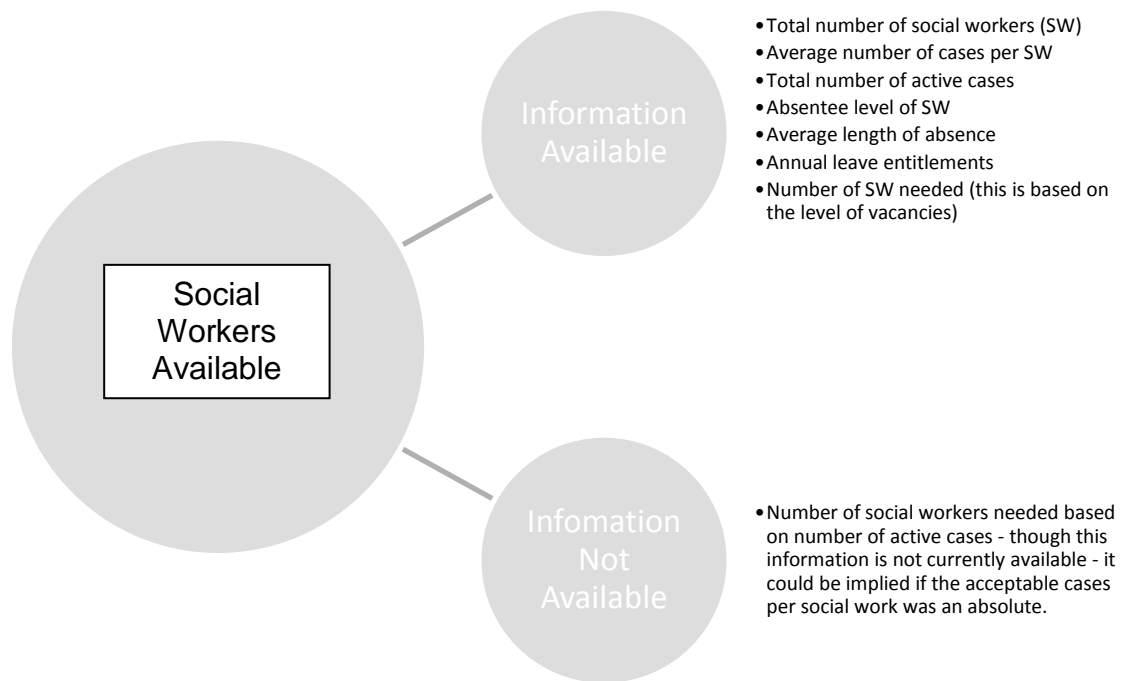


Figure 34: HR Management Information Mapping

Based on the initial models, a couple of key success factors are beginning to emerge but more importantly some key policy questions become apparent. If some key factors related to staff availability are looked at in isolation (see figure 35) it is clear where a policy action to ‘hire more staff’ can create a balance in the system.

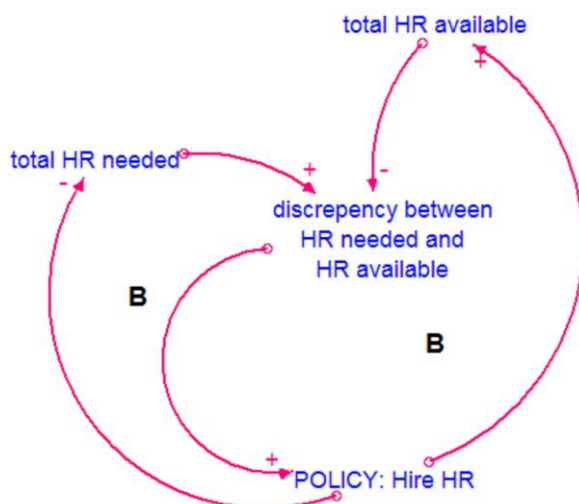


Figure 35: HR Management snap shot with hiring policy



In 2010, Navid Ghaffarzadegan, along with John Lyneis and George P. Richardson published the paper 'How Small System Dynamics Models Can Help the Public Policy Process'. Drawing on the work of other System Dynamics practitioners such as Jay Forester and Barry Richmond, they review two relatively small simulation models used to inform policy and address the five barriers to public policy decision making as they see it; policy resistance, need and cost of experimentation, need to persuade different stakeholders, overconfidence in policy decision makers, and the need for endogenous perspective. The two examples given are then evaluated for their usefulness at addressing these five barriers. While there are clear benefits to their approach in addressing these barriers and in identifying where policy action is needed, it raises questions that are not considered. For example, their Urban Dynamics model contains a policy action to 'generate more jobs' which is triggered when the labour force become significantly larger than the number of jobs available but is it realistic to set a policy "generate new jobs" without considering how these jobs will be generated, in which sector and at what cost? Much like the example given in the HR Management model, the policy 'Hire new staff', which has clear benefits, does not show the 'whole' story, and raises several policy related questions:

1. How big does the discrepancy need to be to initiate the policy?
2. How big is the delay between the decision to hire and employment of new staff?
3. How many new hires are needed?

4. What are the alternatives to hiring permanent new staff?
5. What is the cost of hiring?
6. What is the financial impact of new hires?
7. Has the correct problem been identified?

A very simplified model with only 4 factors has generated over half a dozen questions and with more factors added, more questions will be raised. The answers to these questions form our list of information needs and the lag (or lead) indicators that should trigger a policy action. A more detailed analysis of the models and the information they both use and generate in the formulation of policy action plans is discussed in the next chapter.

## **6.6 – Conclusion**

The focus of this chapter has been the use of three separate case studies to discuss the methodological choices made in the development of a proposed framework for public policy design and analysis. The focus has been on the use of systems thinking tools and techniques to effectively establish context and frame problems considered complex and ambiguous.

Each of the case studies was discussed in relation to how they supported the thinking and structuring of the framework in development and how they supported the application of the framework. Case study 1; The Mid-Staff Case, established how SD can be used to map causality in order to 'Frame the Problem' using only inquiry evidence. This is beneficial as most policy decisions are reactive and are usually brought about as a result of a major incident leading to an inquiry or major review (Kendrick 2004). It also meant

SD could successfully map causality based on participant interviews in Case Study 3.

Case study 2; The Environment Agency Wales, looked more specifically at the mixing of methodologies that form the basis of the proposed framework. This work proved useful in both 'Establishing the Context' and 'Framing the Problem' and used the methodologies chosen in the context of supporting policy decision-making. This case study also proved invaluable in shaping and structuring the thinking behind the development of the framework.

The third and final case study; Child Protection, led to a greater synthesis of the methodological choice and provided the groundwork for a fuller application of the proposed framework. However, up to this point the focus has been on the first 3 steps of the proposed framework and the use of qualitative models and their supporting information, with the quantitative elements discussed only briefly and in terms of 'soft' factors. The next chapter will discuss the development of quantitative models and the role of simulations in understanding the impact of policy action. This would form steps 4 and 5 of the framework and allow more detailed analysis of the proposed framework and its application.

## **Chapter 7 – Analysis, Evaluation and Contribution**

### **7.1 – Introduction**

Three levels of evaluation are used; evaluation of the proposed framework, evaluation of applying the framework and evaluation of the product of applying the framework.

Also, the quantitative models that were created using the qualitative models discussed in the previous chapter are presented. This facilitates the testing of the validity of qualitative information in informing data collection to support policy decision-making.

The work undertaken in this thesis is evaluated for its validity in the context of policy decision-making and its applicability as a contribution to the field of Policy Informatics. To demonstrate the contribution, comparison is made between the models created as part of the development of the framework against those created and used by Professor Eileen Munro in her review of child protection. This is a clear straight evaluation of the newer proposed method over the existing older method.

The proposed policy design and analysis framework is evaluated against the cyclical frameworks most commonly used in public policy decision making, using concepts based on Frederik P. Brooks' 1986 paper "No Silver Bullet, Essence and Accident in Software Engineering" as an evaluation tool. The core concepts of this evaluation tool are also used to evaluate the framework being applied in the field of child protection. The choice of Brooks' 'Silver Bullet' is not because it is either more or less valuable than other evaluation techniques, but rather due to the author's familiarity with the work.

As part of the evaluation of the techniques, the concept of model validity will be discussed as models created through the application of the framework also need to be assessed and evaluated.

This evaluation will prove how a multi-methodological approach would lead to better informed policy decision-making. In discussing the evaluation, the contribution of this body of work to the varying applicable fields of research will be highlighted.

## **7.2 – Brooks’ ‘No Silver Bullet’**

In 1986, Frederick P Brooks wrote an essay discussing the concept of a ‘silver bullet’ in software development projects. The idea being that there exists no methodology, tool or technique in either software development or project management that addresses the issues with reliability, simplicity or productivity in the production of software. Although, seemingly irrelevant to the work outlined in this thesis, the ‘bullets’ described as essential to addressing the issues, do provide a useful independent means of evaluating the proposed framework for policy design and analysis against the traditional cyclical policy decision making models. Unlike other methods of software evaluation such as FURPS (Functionality, Usability, Reliability, Performance and Supportability) or CUPRIMDSO (Capability, Usability, Performance, Reliability, Installability, Maintainability, Documentation, Serviceability and Overall) (P. Miguel, Mauricio, & Rodríguez, 2014), Brooks Silver Bullet considers complexity which is a key feature of policy decision-making. This makes evaluation using this tool more adaptable to other evaluation

purposes as the core concepts can be easily applied to areas that differ from its original intended purpose; namely evaluation of software.

The bullets described by Brooks are complexity, conformity, changeability and visibility. Taking these concepts in the context of policy decision making, the two frameworks are compared.

### **7.2.1 – Complexity**

Brooks describes complexity within software as the non-linear linkages between all the elements of software that make up a software system or project, where no two elements are the same (Brooks, 1986). In public policy decision making, the complexity exists because of the number of diverse stakeholders, organisations and factors that need to be considered. However, in considering complexity in the context of Human Activity Systems (HAS) as described by Checkland (1963), it is worth considering complexity in the context of Charles Perrow's Normal Accident Theory (NAT), which in its most simplistic form, is the idea of the occurrence of accidents in environments of high complexity and tight-coupling as inevitable (Perrow 1984). Although the theory was developed in response to the nuclear meltdown at Three Mile Island in 1979 and the human aspects of that failure (Sills et al. 1981), the underpinning ideas are no less relevant in the area of child protection.

The organisational structure of child protection and the rigid working practices and regulations that it is subject to, make it a tightly-coupled organisation and, the multiple agencies involved, which have equally tightly-coupled structures, make it an extremely complex environment. It is the

unexpected interactions and seemingly independent failures that create the perfect environment in which accidents will inevitably occur. This tight-coupling means that the initial interactions and independent failures escalate to complete system failure (Perrow, 1984). In the context of child protection this combination of high complexity and tight-coupling has culminated in systemic failure leading to the deaths of a children; “this was not a failing on the part of one system, it was a failing on the part of every system” (Laming 2003).

Public policy has been described as intrinsically complex and the frameworks, methodologies and processes used to support policy decision making must be able to cope with and manage this complexity. One of the main criticisms of the cyclical policy decision making model is its linear nature which conflicts with the complex environments in which policy decision making exists. Although, to both understand and communicate complexity, some simplification is required, the cyclical model does so in a reductionist way. This means some of the emergence that results from the complexity, is lost. The proposed framework offers a methodological approach that embraces the complexity, simplifying it in the form of models of representation that consider the emergent properties and the interconnectedness of the environment in which policy decision making exists.

### **7.2.2 – Conformity**

Brooks describes how software is required to conform to, organisational structure, processes and working practices as well as conforming to the

complexity of the software development processes themselves. However, it is not uncommon that the conformity is achieved in the opposite way by processes and working practices changing to meet the needs of the software that supports them, and performance measures are dictated by the data that is easily collected. This means the software dominates instead of the organisational needs.

In the context of policy decision making, conformity to the norms of the society in which the policy will operate is considered as well as conformity to the organisational structures, processes and working practices of those responsible for making the decisions. In addition, the policies need to consider conformity to the environment in which the policy action is implemented. This can also mean conforming to the media or populous pressures.

In UK Government, the ROAMEF cycle forms the basis of most policy decision making but policy makers routinely report that the decision making process rarely follows a neat staged approach (Hallsworth & Rutter 2011). This led to the Institute for Government recommending a set of seven 'policy fundamentals' to be used as a checklist in policy decision making; clarity of goals, open, evidence-based idea generation, rigorous policy design, responsive external engagement, thorough appraisal, clear understanding of the role of government and accountabilities, and the establishment of effective methods for feedback and evaluation ((HM Government 2013). The 'policy fundamentals' are designed to be non-sequential and used by policy makers prior to proceeding with a policy action. Alongside the seven 'policy fundamentals', the Department for Education introduced five policy tests in



2012 to identify key challenges and ensure the deliverability of policy actions (see table 5).

*Table 5: The Department for Education - 5 Policy Tests*

1	PURPOSE	Are you absolutely clear what the Government wants to achieve? Do you have a very clear idea of the high-level outcomes and outputs that the Government would like to see?
2	ROLE	Are you absolutely clear what the Government's role is? Is there definitely a problem here that can only be fixed through some form of Government intervention?
3	EVIDENCE	Are you confident that you are providing world-leading policy advice based on the very latest thinking?
4	CREATIVITY	Are you confident that you have explored the most radical and creative ideas available in this policy space...? including doing nothing?
5	DELIVERY	Are you confident that your preferred approach can be delivered?

The adoption of the 'policy fundamentals' and the five policy tests is a starting point for policy decision makers which allows them to follow a more structured approach to decision making. It also addresses the underestimation of the value of policy design, which is an issue raised regarding ROAMEF (Hallsworth 2011).

In evaluating the proposed framework for the decision-making process for conformity, consideration needs to be given to both the seven 'policy fundamentals' (PFs) recommended by the Institute for Government, and the policy tests (PTs) devised by the Department for Education. Table 6 details where the proposed framework addresses conformity in these areas.

Table 6: Evaluation of Proposed Framework against PFs and PTs

<i>Policy Fundamental or Test</i>	<i>Description of policy fundamental or test</i>	<i>Evaluation of proposed framework</i>
PF 1	Goal clarity	Establishing the context and framing the problem provides clear unambiguous goals. The use of SSM as a PSM enables all perspectives of the goals to be considered
PF 2	Open and evidence-based idea generation	The mapping of causality means that policy action is identified through evidence provided by the models
PF 3	Rigorous policy design	The framework is designed to provide a robust multi-methodological approach to both policy design and analysis.
PF 4	Responsive external engagement	This is addressed by the participatory approach used in the creation of the models to establish context and frame the problem. The iterative process involved in the models' creation provides a response to issues raised and ideas presented by participants in the process.
PF 5	Thorough appraisal	The simulation stage allows comprehensive testing of the policy action.
PF 6	Clear understanding of the role of government and accountabilities	Using SSM to capture the multiple perspectives allows the role of government to be fully considered. The identification of activities for monitoring and control, detail where accountability lies.

PF 7	Mechanisms for feedback and evaluation	The simulation models allow policy actions to be rigorously tested over varying time periods and varying degrees of change. The results are evaluated to ascertain where they meet the desired outcomes. This can be achieved prior to implementation but, in addition, the inclusion of implementation planning as part of the design and analysis framework means that consideration is given to long term evaluation following implementation.
PT 1	Government goals (PURPOSE)	Although clarity of government goals can be captured with the creation of an agreed set of RDs and the resulting SSM models, the framework goes a step further in its potential to identify unintended consequences of a policy action or where the outcomes differ from those outlined by government.
PT 2	Is there really a problem? (ROLE)	By adopting the use of a robust PSM, the problem can be clearly identified and the focus of the early part of the framework is establishing the problem as it actually exists rather than as it is perceived to exist
PT 3	Provision of evidence and latest thinking (EVIDENCE)	The proposed framework provides an evidence-based approach to policy design and analysis using a combination of thinking methodologies, tools and techniques. It applies a non-linear holistic approach in the problem space and a novel approach to the solution space in the form of organisational modular modelling.
PT 4	Confidence in the ideas in the policy	The proposed framework provides the 'safe' space to test even the most radical of ideas and the

	space (CREATIVITY)	interconnectedness of the models provides visibility on the impact of the ideas.
PT 5	Can the preferred approach be delivered? (DELIVERY)	The inclusion of implementation planning means that testing in a simulation environment provides details of the delivery mechanisms needed as well as establishing if delivery is feasible or needs to be compromised.

### 7.2.3 – Changeability

Brooks talks of changeability in software development as a need to be able to adapt to external pressures and changes in the users, legislation and technology due to advances. In the context of policy decision making, the need exists for adaptability to cope with changing political landscapes, media and public pressures, organisational structures and desires and goals. The policy making process, whilst existing in this changing environment, does not always allow for the changes to occur during the process.

The cyclical, and therefore linear, nature of the more traditional policy processes mean that policies are often terminated, rather than implemented, at the end of the policy decision making process. Their ability to adapt mid-way is limited and they are more likely to respond to changes with early termination and a restart of the whole process. The incremental model (discussed in chapter 3, section 3.3.1) can adapt to small incremental changes but is not suitable for large-scale sweeping change. In addition, the level of commitment to a policy desire, and the overconfidence of the policy makers seeking to implement it, can have a detrimental impact on its ability

to adapt to changes in circumstances or outcomes (Ghaffarzadegan et al. 2015).

The proposed framework addresses the issues of changeability by the inclusion of change as a perspective to be modelled using SSM and the SOSA method. This provides the ability to add or remove systems as they are needed. The hierarchical mapping of causality, as different levels of abstraction, means the impact of change can be monitored. The participatory approach seeks to ensure early 'buy-in' by those who would be responsible for implementing the policy action, delivering the action plans or those likely to be beneficiaries of the policy action, making the process of change more acceptable.

#### **7.2.4 – Visibility**

Brooks talks of software in terms of “unvisualisable” since conceptual control over software is virtually impossible to achieve (Brooks 1986). Although the structure of the software is simplified by the models used to visualise the flow of control and data, dependency patterns and name-space relationships, it lacks the necessary coherency to be able to understand the nature of the software or communicate that understanding fully within a single design. However, advances in software design methodologies have seen significant improvement in this area, the concept of visibility in this context is particularly useful when evaluating methods for policy design. Much like software design it is inherently difficult to fully capture the complete picture of complexity that is policy decision making.

The cyclical policy process suffers the same drawbacks as described by Brooks, in that policy decision making rarely cleanly follows the process. It was criticisms of the cyclical model that gave impetus to the research in policy design (Hood 2004). However, even in the field of policy design not all aspects of policy decision-making are adequately captured and visualised. The rise of Policy Informatics as a field of research was due to the lack of attention paid to information used and generated by the policy decision making process (Johnson 2015). This led to a focus on visualisation of the data and information as part of the policy decision making process. The proposed framework can clearly identify and visualise the flows of information whilst retaining the visualisation of complexity. This visualisation also provides the rationale for data collection as part of the policy process and for its use in evaluating the implementation of policy action.

The concept of the 'silver bullet' as described by Brooks was to address concerns and considerations in software development methodologies within all four of its elements; complexity, conformity, changeability and visibility. The idea being that a methodology that copes with all four equally is considered the 'silver bullet'. By using those same concepts, the proposed framework when compared with the existing frameworks can be considered the 'silver bullet' of policy decision making. This is not to say that elements of the proposed framework don't already exist in previous frameworks for policy decision making, policy design or policy analysis. The main difference is the methodological choices that are embedded into the proposed framework. Whilst there has been much effort in the last 15 years to improve policy decision making in the UK (Davies, Atkins, & Slade, 2018), there

appears to be enduring issues that, despite numerous efforts aimed at improvement, continue to exist. The desired characteristics of policy decision making; outward looking, evidence-based, inclusive, forward looking, joined up, and evaluation, are clear (Hallsworth, 2011), but despite this clarity, there continues to be ambiguity linked to how to achieve them. The proposed framework offers clarity to that list of desired characteristics by providing the methods, tools and techniques to achieve them.

### **7.3 – Analysis and Evaluation in the Case of Child Protection**

In addition to evaluating the proposed framework against existing frameworks for policy decision making, the product of applying that framework is evaluated against the products resulting from Professor Eileen Munro's review of child protection services. The similarity of approach in the use of systems thinking methodologies in her work make the evaluation both possible and relevant. To fully evaluate against Munro, the models created and used, in the development of this thesis, are compared and contrasted with those created and used as part of Munro's review. To ensure clarity of purpose and provide an independent means of evaluation, the same concepts, described in the previous section, are applied, where appropriate, and discussed.

#### **7.3.1 – Producing and Evaluating the Qualitative Models**

It is important to note that the most thorough evaluation would be to take a new child protection case study and compare the results from the techniques of Munro to the results from the techniques in this thesis. However, this would require a level of access and resource that are not available therefore

an alternative evaluation method is used. The models created as part of the Munro review are replicated and assessed for validation and compared against those created as part of this thesis. In validation of the models, the core concepts of System Dynamics are considered, and the causality detailed is reviewed. Figure 36 shows the model used by Munro. This model formed the basis of an argument to reduce the prescriptive measures used in child protection, but it generated some issues.

The boxed elements highlight where issues are raised regarding the validity of the causal relationships and clarity of rationale behind them. For example, it is not clear how the 'variety of circumstances of children and young people' impact on the 'quality of help to children and young people'. Using Brooks' concept of visibility, the causal relationship fails, as there is no clarity in the rationale to justify the relationship between these two factors. It could simply be that some causal elements are missing but the addition of those causal elements could change the structure of the model, and therefore the message being portrayed by the model. It also raises the issue of assumptions leading the model rather than the model questioning assumptions. Namely, has the model been created to justify an existing way of thinking? Following the publication of the "Munro Review of Child Protection", Munro has been criticised for failure to see beyond the current bureaucratic structure of the system (Barret, et.al, 2013) and the models produced indicate that this could be the case.



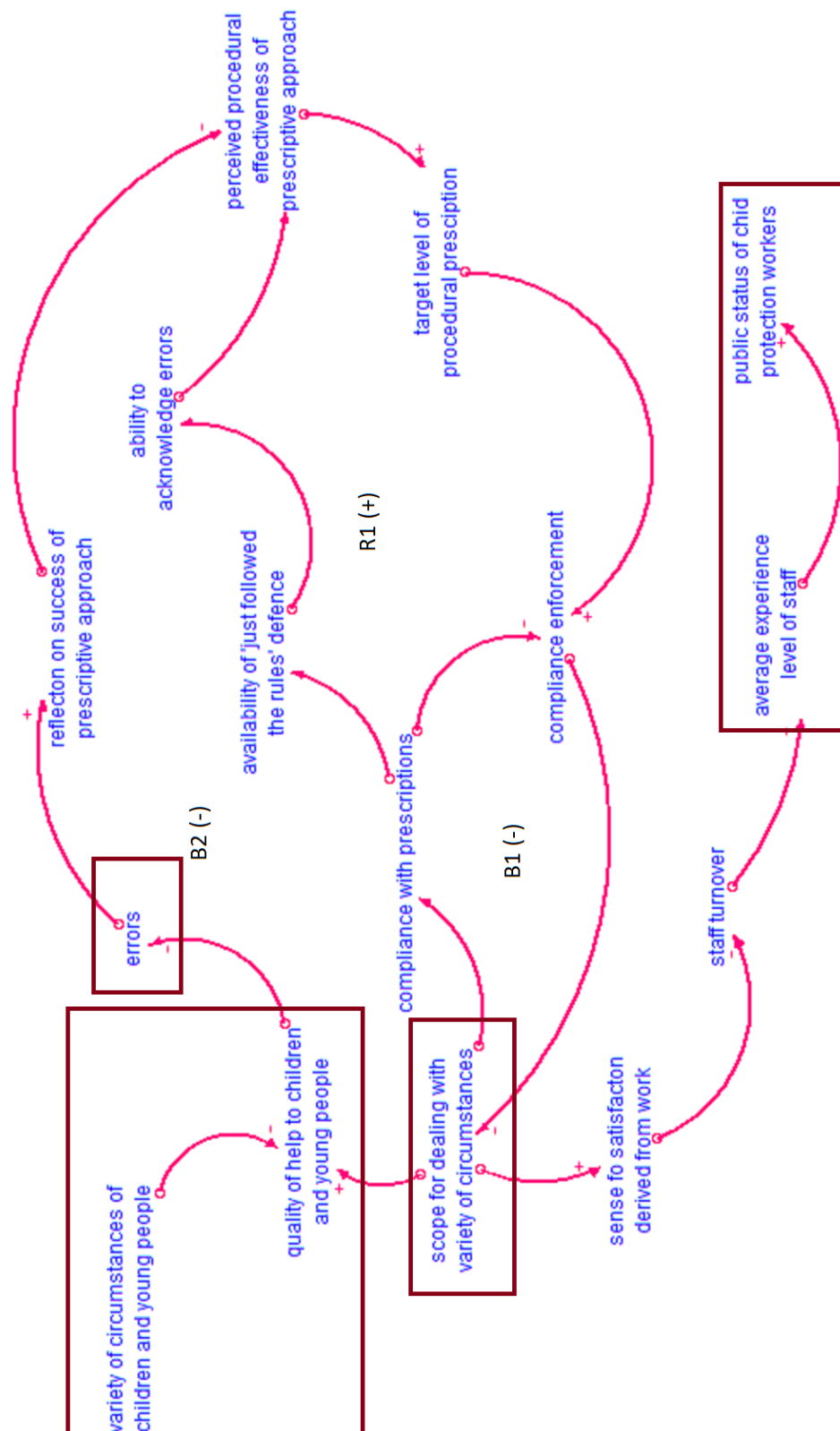


Figure 36: Munro's Model of Child Protection taken from "The Munro Review of Child Protection, Part One: A Systems Analysis"

Another issue is with the causal relationship between the elements 'average experience level of staff' and 'public status of child protection workers'.

Again, the issue of a lack of clarity of rationale is evident, as the link between staff experience and their public status is ambiguous. It is more useful to look at the impact of 'errors' on public perception and the link of public perception on the 'sense of satisfaction derived from work', yet this causality has not been modelled. It is possible that the level of experience of a social worker has a positive impact on the perception of their status by clients of the service. This in turn leads to positive outcomes, as respect of that experience leads to a positive response by those using the services.

The other seemingly irrational relationship is between 'quality of help to children and young people' and 'errors' as, based on popular definitions of quality, this is usually the other way round with the 'number of errors' being a measurement to determine the 'level of quality' (Revere & Black 2003). If the relationship were to be modelled this way it would change the entire structure of the model.

Figure 37 shows the model created using the proposed framework in response to Munro's model but with changes to represent a clear rationale for the relationships between factors. To ensure that a fair comparison is made, the model has been created to the same level of abstraction and using the same language to describe the factors.

The model depicted in figure 37 shows clear reinforcement loops structures linked to quality of care, staff morale, stress, and staff absence and vacancies. This model indicates that a reduced quality of care is a result of

rising caseloads per social worker, which is due to increased vacancies and absence linked to reduced staff morale. This is a vicious circle that indicates a need for policy action.

The production of the qualitative models used to establish the context and frame the problem, as part of the proposed framework, provide a clear picture of the state of the situation and where policy action is required. This level of visibility, in both the causal relationships of the factors and in identifying the areas where the system is likely to go out of control, meets the concepts of 'visibility' as described by Brooks (1986).

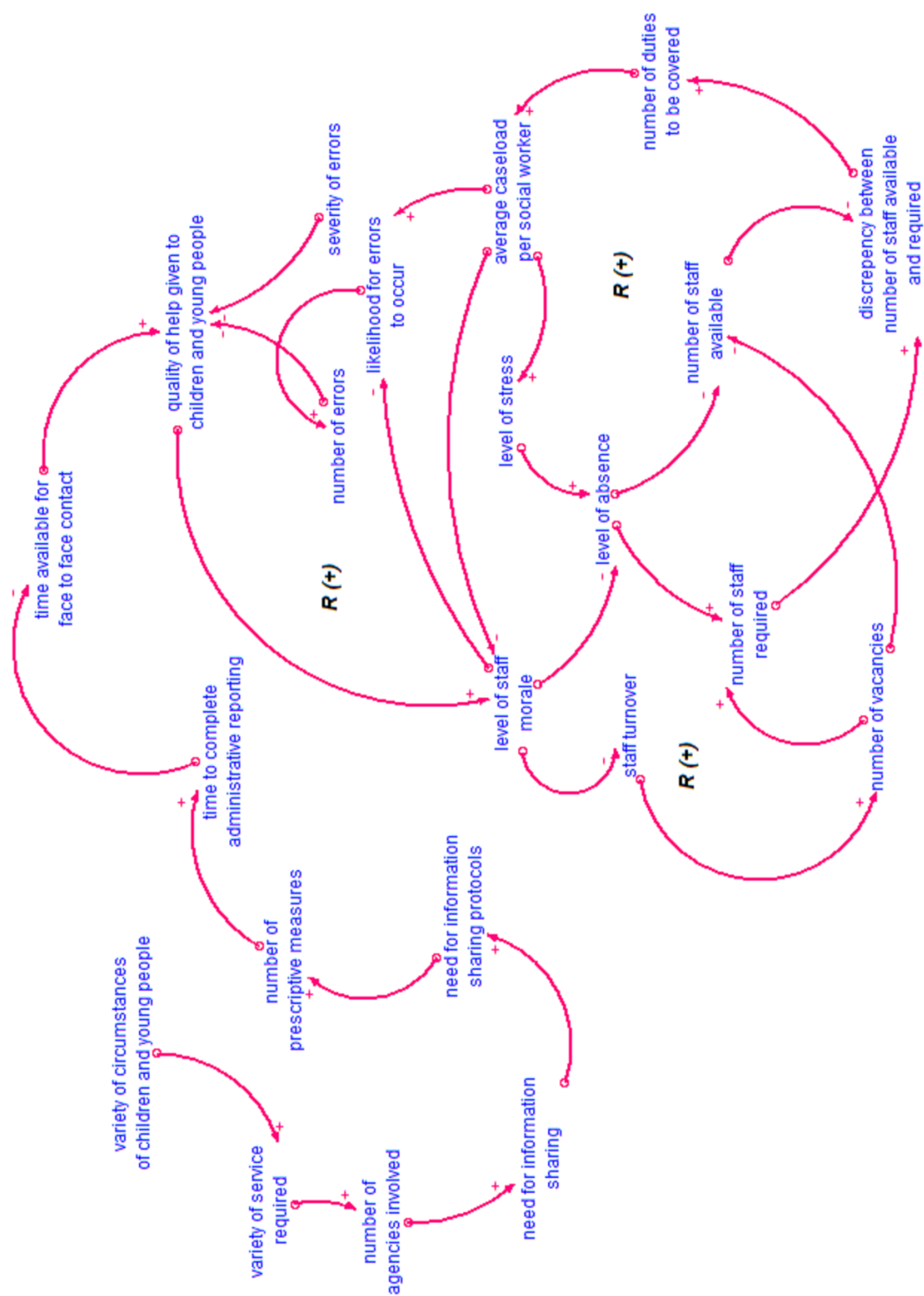


Figure 37: Influence Diagram created as a comparison to Munro's model

### **7.3.2 – Understanding the Information Needed for Producing the Quantitative Models**

Once an understanding of where a policy action is required, and the information needed to support that action is reached, the creation of the simulation diagram can begin. It is important at this stage to consider the concept of unit matching. Unit matching ensures the accuracy of the model's dynamic behaviour and it is at this point that consideration is given to the metrics which will be used to measure the factors of the model.

In establishing unit consistency, the qualitative models are scrutinised for their accuracy in representing the system and its causality. For example, in the initial HR Management Influence Diagram outlined in chapter 6, section 6.5.4.5.3, figure 30, the 'need for recruitment' factor is a dependent factor of both 'leaving rate' and 'number of social workers available' but the units don't match. The 'number of social workers available' would be measured in 'people', the 'leaving rate' is a percentage figure and the 'need for recruitment' is an arbitrary figure to represent 'need'. What is required are factors that allow consistency in the measurement such as 'impact of number of social workers available on the need for recruitment' and 'impact of the leaving rate on the need for recruitment'. However, as figure 30 (chapter 6, section 6.5.4.5.3) shows, the policy action to hire new staff is a dependent factor of 'discrepancy between staff available and staff needed'. This would mean the policy action would be triggered once the discrepancy reached an undesired level. This level of scrutiny not only improves the understanding of the model message but also takes away any ambiguity.

This level of analysis makes the rationale for the collection of data to support the policy action, and the information required to measure the impact of that policy action, clearly visible. This visibility in the link between the models and the rationale for the information needs detailed by Munro is less clear.

In the final report produced as part of her review of child protection, Munro (2011), detailed the performance information items that should be collected and used for policy development and to monitor the impact of system changes. To ensure consistency, the chosen area of focus for comparison, between Munro's proposed information requirements and those resulting from the application of the proposed framework, will be those linked to the child protection workforce. Table 7 shows the information to be collected and the rationale provided by Munro to justify the collection of this information.

*Table 7: Performance Information Set as taken from 'The Munro Review of Child Protection: Final Report' 2011*

<b>Domain &amp; Descriptions</b>	<b>Information Item</b>	<b>Rationale</b>
State of workforce  Agency Staff	Social Worker:  a) Vacancy rate b) Turnover rate c) Absence/sickness rate	Together, these would provide a good picture of social worker capacity and workforce stability, factors which contribute to overall quality of service provision
	Percentage of social work posts filled by agency workers	
Caseload	Number of changes of social worker in contact with the child from first contact with children's social care	Provides an indication about the consistency of relationships between providers of services

Changes to social worker		and children and underlines the importance of continuity
Social Workers Survey	Average social worker caseload	Enables workload monitoring but allows for diversity in the way that cases are managed locally
Other agency surveys	<p>Percentage of children and young people's social workers who consider that:</p> <ul style="list-style-type: none"> <li>a) Their interventions have improved the safety of the children</li> <li>b) They received adequate professional supervision and support</li> <li>c) Their caseloads are manageable</li> <li>d) They are able to spend enough time with children and young people</li> </ul>	It is crucial that feedback from social workers is sought so that it can inform learning and drive service improvement
	<p>Percentage of staff from:</p> <ul style="list-style-type: none"> <li>a) Police</li> <li>b) The health services</li> <li>c) Education</li> </ul> <p>Who consider that they have a good understanding of children's social care referral thresholds and procedures</p>	It is crucial that feedback from partner agencies is sought so that it can inform learning and drive service improvement.

Munro is careful to point out that the information items taken in isolation cannot clearly indicate good or bad practice, but should be used together to provide context for discussions about child protection services (Munro 2011).

Mentions of caseload or workload in the information set is linked to a rationale of learning provision, service improvement and diversifying the way in which cases are managed. However, there is no mention of workload or caseload in relation to understanding social worker capacity or workforce stability despite extensive research linked to the impacts of workload on stress and performance (Cooper 1998; Cooper 2001; Krueger, Gerald 1989; MacDonald 2003).

In January 2015, Community Care's survey of social workers estimated a cost to Local Authorities of at least £45m due to lost labour because of stress (Schraer 2015). The survey, and resulting article, found that 30% of all social workers had taken time off work during the year as a result of stress and cited "extreme resourcing pressures" as a cause (Schraer 2015).

The lack of consideration given to workload/caseload and stress linked absence and/or staff turnover could be an indication of where Munro has failed to fully represent the complexity of child protection in her models or where the models' lack the visibility required to ascertain the assumptions made, and how they link to her rationale for information item collection. Either way, the models fail to meet the evaluation criterion of visibility and complexity as described by Brooks.

By comparison, the model depicted in figure 37, was created to aid in establishing the context, and framing the problematic issues present in child



protection social care. It shows a clear relationship between workload, stress, and staff absence. The resulting reinforcement loop structure indicates a need for policy action to prevent the 'system' from going out of control. This is a key difference in the Munro model (figure 36) and the models created using the new approach (figure 37) as an attempt is made in figure 37 to ensure the inclusion of the impact of workload. In moving the qualitative Influence Diagram to a quantified model suitable for simulation, the following table 8 was produced to show some of the additional information items identified:

*Table 8: Information Items Identified in Moving from Qualitative to Quantitative Modelling*

<b>Domain &amp; Description</b>	<b>Information Item</b>	<b>Rationale</b>
State of workforce  Agency Staff	Social Worker:  a) Vacancy rate b) Turnover rate c) Sickness absence rate d) Reason for absence e) Average number of days off per sick absence f) Number of cases per social worker	These provide a good picture of social worker capacity and workforce stability.  Workload related absence can provide insights for policy change linked to case management.
	Number of agency workers  % of posts covered by agency workers	
Caseload  Changes to social worker	Number of social workers involved per case  Average time spent on administration per case	Provides an indication about the quality and consistency of relationships between providers of services and children  Provides a picture of continuity

Social Workers Survey	Average workload per social worker	Provides insights into workload management linked to case management
Other agency surveys	Agency cover rate Cost of agency staff Average pay of agency staff	Provides an insight into costs of workload related absence on providing additional cover  Provides an insight into why agency option is preferred over permanent roles

Whilst there are some similarities between table 7 and table 8, there are significant differences with the information items that are identified to give a fuller picture of the impact of workload on absence.

### 7.3.3 – Building the Simulation Diagrams

The SD models created and discussed in this thesis were created using the 'iThink' version 9.1.4 software. Familiarity of use, ease of use, and advanced functionality enabling modular modelling were the reasons behind the choice of this software.

The model shown in figure 38 is the HR Management simulation diagram that was created using insights gained from the qualitative modelling of the situation.

Having identified a need for policy action related to workload, based on the loop structure in the model shown in figure 37, an additional related model was created to look more closely at the process for case management. This model is depicted in figure 39. The modular structure of the models allows for factors in one model to act as either inputs or outputs to factors in another

model. This means that each of the modules in the high-level organisational model (shown in chapter 6, section 6.5.3.2.3, figure 29) contains lower-level models that are interlinked). The models have been created in different colours to clearly show where factors from one model are used in another. For example, the HR Management model, coloured blue, in figure 38 contains 3 factors, coloured purple, that have been taken from the Case Management model.

Relationships between the factors are shown using arrows and equations are built to indicate the impact of those relationships. The equations for the models shown in figures 38 and 39 can be found in Appendix C.

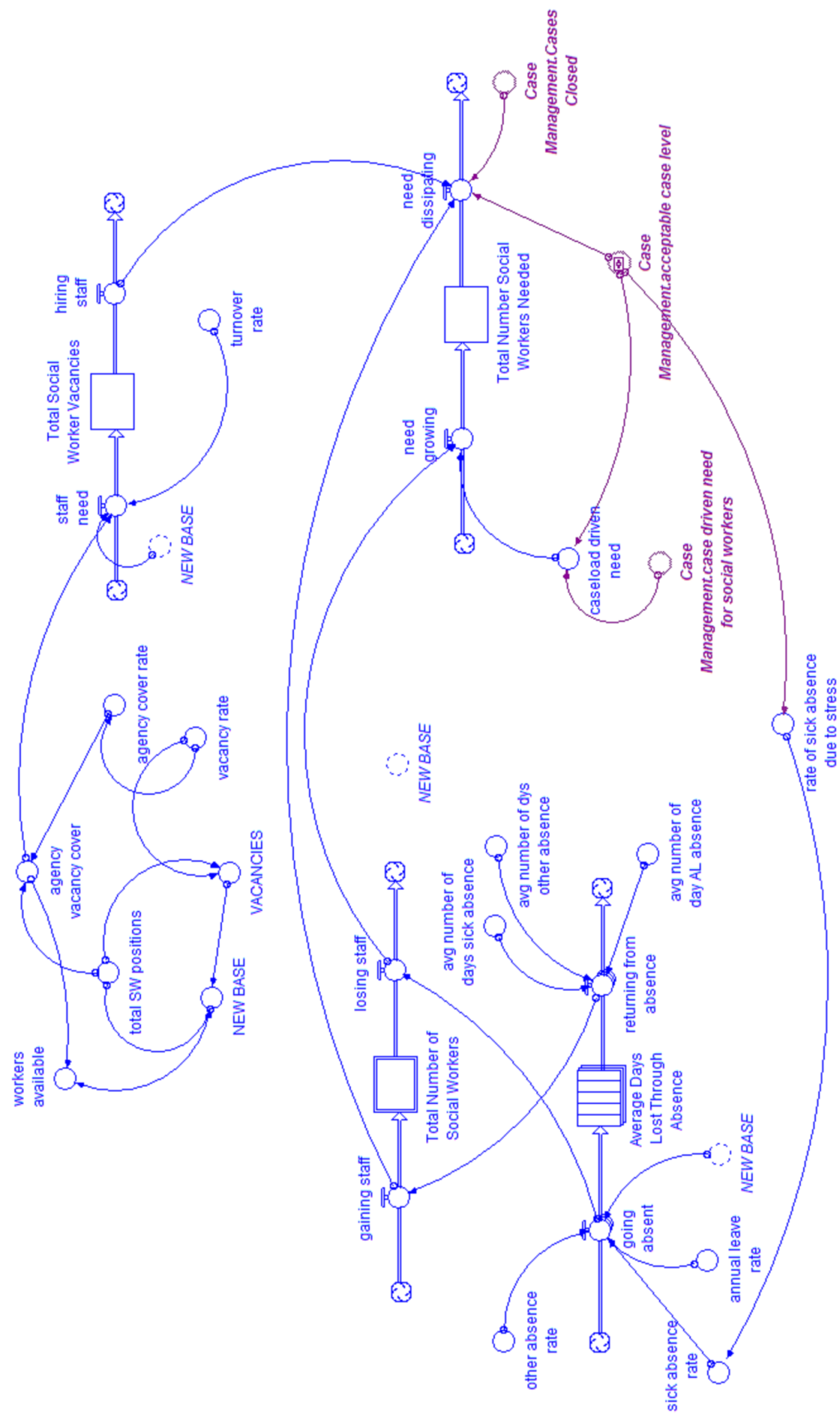


Figure 38: HR Management Simulation Model

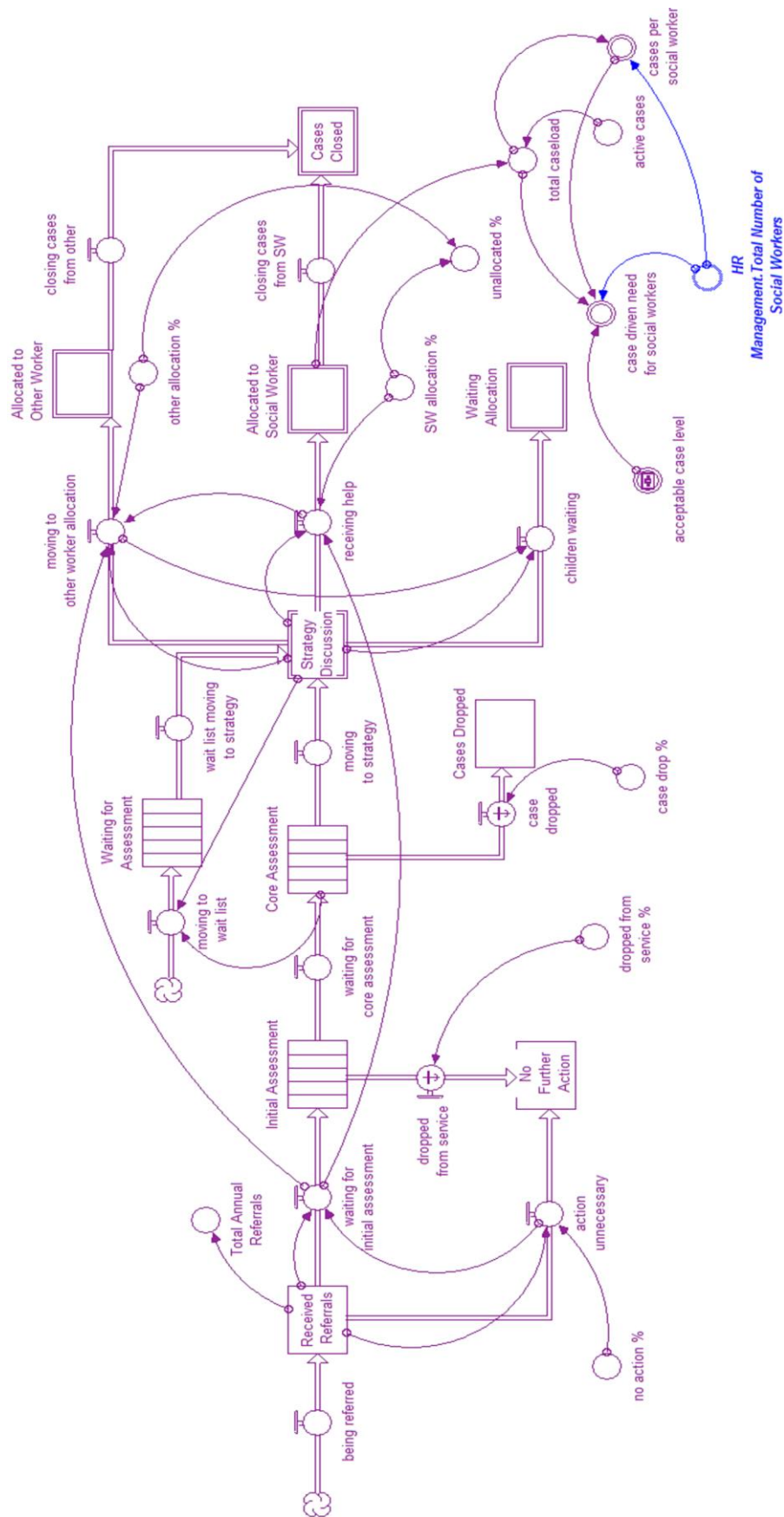


Figure 39: Case Management Simulation Diagram

Once the models have been created and populated with the necessary data and equations, experimentation on the models can be conducted. It is important to note that figures used in the models need to maintain unit consistency within the model. In addition, the figures used need to reflect behaviour over time so factors such as 'leavers' would be represented as an average percentage called 'leaving rate'. Representing such factors as a percentage figure that fluctuates over time makes it easier to adjust over time.

A need for policy action linked to workload, stress and staff absence was identified through the loop structure of the qualitative model depicted in figure 37. As such, this was the focus of the first experiment. In building the models and conducting the experiments certain assumptions were made based on figures provided by the Office of National Statistics (ONS) for the year 2013:

- Sick absence increases in line with workload but only where workload exceeds 20 cases per social worker and to a maximum of 6.7% as this was recorded sick absence rate for the year 2013 for child services
- Agency cover rate is set at 2% below the vacancy rate based on the figures recorded for 2013
- Vacancy rate is fluxed between 21% and 24% as the vacancy rate in child services was recorded as 24% at its maximum in 2013
- Average number of days per sick absence are fluxed between 1 day and 30 days

- Average number of days per other absence are fluxed between 1 day and 5 days
- Average number of days per annual leave absence is fluxed between 1 day and 10 days
- All set figures are taken from the National Statistics Office reported figures for 2013
- All fluxed figures are modelled using a 'Random' function

#### ***7.3.3.1 – Experiment Example: Caseload Related Recruitment***

This example experiment looked at the impact of introducing a policy to recruit staff based on caseload need. It varied the acceptable level of cases per social worker from 16 at its lowest to 50 cases per social worker at its highest and recruited staff when the need exceeded the availability.

Figure 40 is a graph showing the impact on staff needed as a result of simulating the introduction of a caseload recruitment policy; where 'case driven need' refers to the number of social workers needed. This increases or decreases depending on the number of acceptable cases per social worker increasing or decreasing.

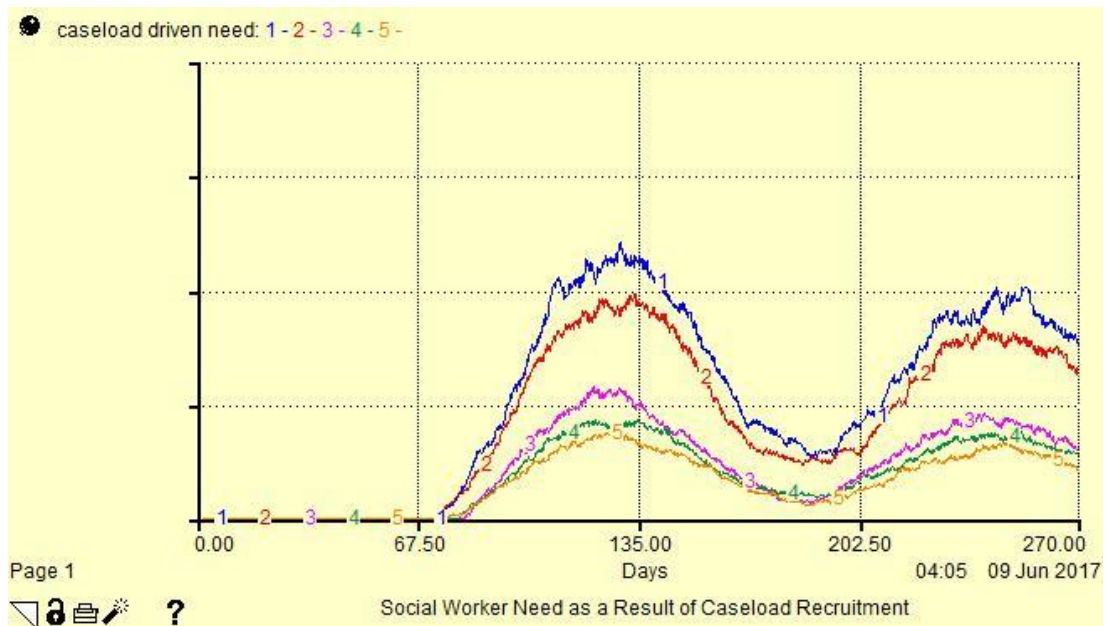


Figure 40: Result of Example Experiment on Social Workers Needed

The graph is a comparative analysis of the impact of case-driven need for social worker recruitment and is labelled as follows:

1. Is the blue line and indicates the recruitment need when 'acceptable caseload' is set at 16 cases per social worker
2. Is the red line and indicates the recruitment need when 'acceptable caseload' is set at 20 cases per social worker
3. Is the purple line and indicates the recruitment need when 'acceptable caseload' is set at 30 cases per social worker
4. Is the green line and indicates the recruitment need when 'acceptable caseload' is set at 40 cases per social worker
5. Is the yellow line and indicates the recruitment need when 'acceptable caseload' is set at 50 cases per social worker

From this graph (figure 40) the need for recruitment is reduced when social workers can take on more cases. However, as figure 41 shows, the more



cases a social worker has, the more likely they are to suffer from work related stress. Figure 41 is the graph showing the results of the simulation looking at the impact of stress on the average days lost through sick absence. Line 1 (blue) is run with a workload of 16 cases per social worker, line 2 (red) is run with a workload of 20 cases per social worker and line 3 (purple) is run with a workload of 30 cases per social worker.

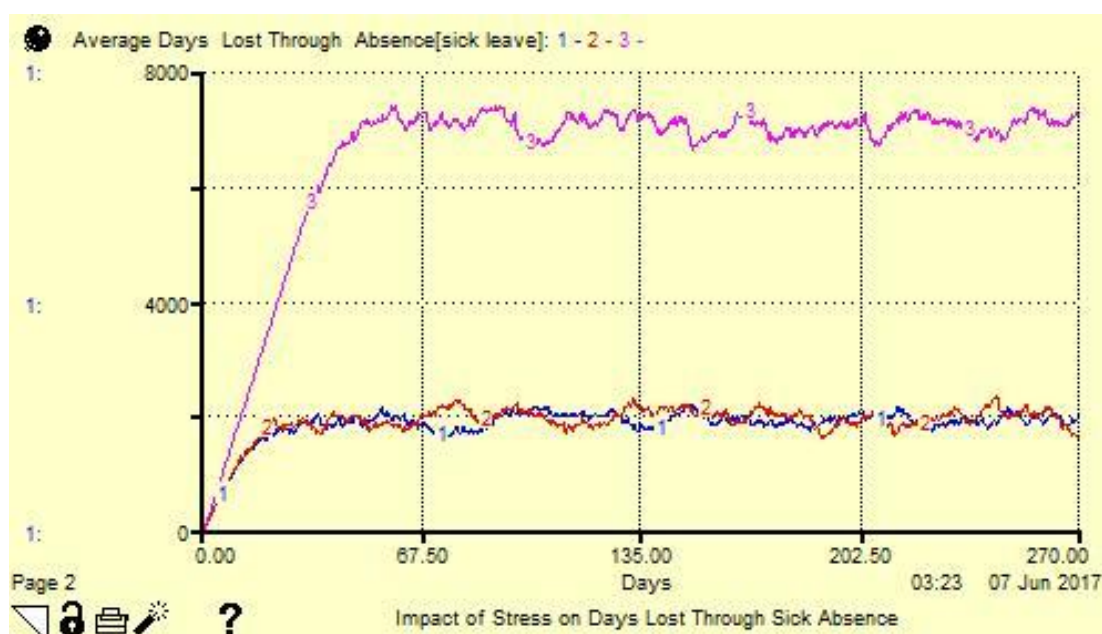


Figure 41: Graph Showing Impact of Stress on Days lost Through Sick Absence

As absences recording 'stress' as the cause of absence, average more than 30 days per sick absence, a significant increase in the total number of days lost is seen once the workload exceeds 30 cases per social worker.

Figure 42 is a graph showing the impact of the allocation of cases to social workers. This is based on an assumption that the acceptable case level indicates where children are waiting for allocation to a social worker to avoid excessive workloads.

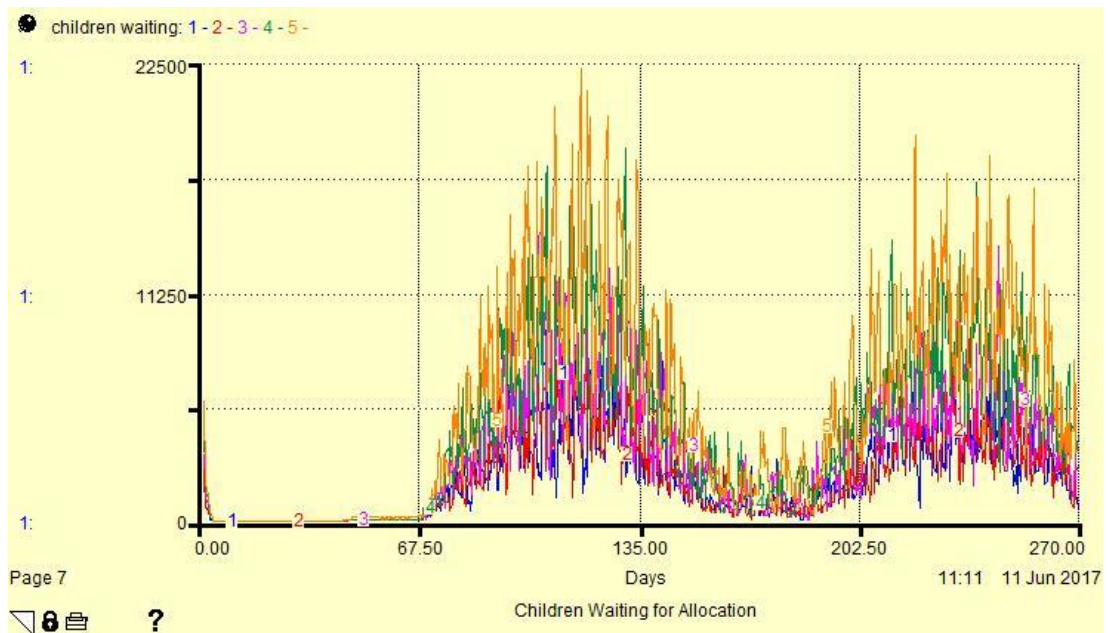


Figure 42: Graph Showing the Impact of Reduced Caseloads on Children Waiting for a Social Worker Allocation

The graph is a comparative analysis and labelled as follows:

1. Is the blue line showing impact at an 'acceptable caseload' of 16 cases per social worker
2. Is the red line showing impact at an 'acceptable caseload' of 20 cases per social worker
3. Is the purple line showing impact at an 'acceptable caseload' of 30 cases per social worker
4. Is the green line showing impact at an 'acceptable caseload' of 40 cases per social worker
5. Is the yellow line showing impact at an 'acceptable caseload' of 50 cases per social worker

The example experiment indicates where a potential 'fix' to the problem, of excessive workloads among child protection social workers, actually caused

issues elsewhere in the 'system'. The purpose of this experiment was not to solve the issue, but to demonstrate a methodological approach that can clearly identify unintended consequences of policy action. Although sick absence among child protection social workers can be reduced by introducing an 'acceptable caseload', the impact of children waiting could be detrimental, as each day a child is waiting for action is another day that child is left in danger.

## **7.4 – Model Validation**

As models are created as a product of applying the framework, it is important to consider model validation as an evaluation of the framework in action.

Model building in the context of policy decision making is becoming an acceptable way of analysing the issues (Sargent 2009). However, there are some contradicting views on model validity as the following statements show:

- “the absolute worth of the model can be no greater than the worth of its objectives...Validity, as an abstract concept divorced from purpose, has no useful meaning” (Forrester 1961).
- “to validate any kind of model means to prove the model to be true” (Naylor & Finger 1967)
- “the process of establishing confidence in the soundness and usefulness of a model with respect to its purpose” (Forrester & Senge 1980)
- “Model Validation is not now an issue of great moment in the development of SSM” (Checkland 1995).

While some researchers in the area of model validation believe that model validity can be proved (Naylor & Finger 1967), others believe that the validity of model can never be fully demonstrated (Forester 1961), (Checkland 1995).

As the primary methodological choices are SSM and SD, the chosen views for validation are those expressed by Checkland and Forrester. This is because they are leaders in their respective fields and responsible for the development of the methodologies used; Checkland with SSM and Forrester with SD. This means the models are evaluated for validity against the following criteria:

- Accuracy of representation
- Clarity of purpose
- Demonstration of usefulness
- Model correctness

#### **7.4.1 – Accuracy of Representation**

Model representation is considered subjective, especially when adopting a participatory approach in building the models. However, as CPTM was used to create the SSM models, the models themselves are able to represent multiple, and often conflicting, viewpoints. This ensures that all these views are considered before consensus is reached and captured in the Root Definitions used to formulate the models.

The models created using SD to establish the context, were again created using a participatory approach. Whilst care needs to be taken when modelling subjective views, causality between model entities can often be

proven in established research. For example, the relationship between workload and stress.

As a participatory approach was used in creating the models, to establish the context and frame the problem, the resulting models could be said to accurately represent the situation as seen by those taking part. Additional causalities were represented using existing well-established research. It is important to note that the SD models created for the purpose of the work represented in this thesis, are at a high level of abstraction and a deeper level of abstraction could provide more detailed representation. However, the resulting behaviour of the models and the 'system' they represent is unlikely to change.

#### **7.4.2 – Clarity of Purpose**

The purpose of the models created is to test the validity of their use within a framework for policy analysis and design. Thus, they were created to represent the multiple viewpoints in establishing context and framing the problem. The ability of the models to do this is evident from the comparison of the examples in this thesis and those from Professor Munro's review of child protection (see chapter 6, section 6.4.1). As the purpose of creating the models shown in this thesis, was to represent the problem space to enable experimentation, then they can be considered 'fit for purpose' and as such meet this criterion of validation.

#### **7.4.3 – Demonstration of Usefulness**

(Forrester & Senge 1980) talk about validation of SD models in terms of their usefulness at representing and establishing the purpose for their creation.

As models are considered valid in both representation and clarity of purpose, then they are considered useful. The ability to identify areas of policy action need and the ability to experiment with policy action means the models further demonstrate their usefulness.

The SSM models created established the context and framed the problem. The participatory approach and level of detail used to represent the multiple viewpoints means the problem space was fully considered and provided a useful frame of reference for the creation of the SD models, allowing for simulation and experimentation. Thus, meeting the validation requirement for usefulness.

Another demonstration of usefulness is the ability of the models to aid in the understanding and communication of the complexity that is child protection services. The Mid-Staffordshire example of using SD modelling to represent the problem situation using alternative means of information gathering (i.e. interview transcripts), proves the usefulness of SD modelling in the context of problem framing to understand the complex nature of the 'system' and establish 'what went wrong'.

#### **7.4.4 – Model Correctness**

This area of validation considers the correctness of the models in terms of whether they are deemed 'correct' in accordance with the 'rules' of the methodologies chosen. The Root Definitions formulated for the child protection case study were 'sanity' checked with Brian Wilson, co-creator of SSM and creator of the CPTM method, to ensure correctness. The resulting

models were also checked to ensure the correct modelling language and syntax were used.

The software used to create the SD models enables checks to be made for unit consistency and correctness of polarity. Correct representation of causality, was checked by participants in the research and other sources, such as journal articles, to ensure that the models not only met the 'rules' of SD but also allowed for the questioning of assumptions.

As a methodology, SD can be flexible in its use and despite being a rigorous methodology, with mathematical constraints, compromises can be made to both gain and communicate understanding of complexity. The value of System Dynamics, in particular Influence Diagrams, is as a means of graphically representing the existing processes and identification of key decision points, information exchange points, and the relationships between individual organisations that are not immediately apparent. Feedback analysis not only reveals the causal impact but also identifies where the need lies for intervention policies or structural change. Furthermore, this graphical representation helps to identify conflicting assumptions and organisational priorities as a source for future areas for research.

Creating an Influence Diagram of the system structure elements, that are within the control of a particular organisation, can be identified, as well as those that the organisation controls through interaction with its environment and other agencies allow for external changes that impact the operation of the organisation.

Using a simulated environment, policies and processes can be tested to establish a best fit that can be used in the formation of robust, yet flexible, service level agreements among multiple agencies and defining dynamic policies that ensure sustainability of the organisational purpose while undergoing enforced challenges brought about by legislative change.

## **7.5 – Conclusion**

The focus of this chapter has been on evaluation and analysis of the models used in the development of the proposed framework for policy design and analysis and detailing the contribution of the research represented in this thesis.

The use of Brooks' concepts of a 'silver bullet' as an independent means of evaluating the proposed framework against existing frameworks demonstrates a contribution in the field of policy science, particularly in the investigation into the problem domain. The proposed framework offers a clear methodological choice for investigating problem situations, establishing context for public policy consideration and framing the problem.

It is clear from the comparison between Munro's work, and the work conducted in the development of this thesis, that a better understanding of the problem space that is child protection is achieved using the proposed framework. This is because the models created can be validated against the chosen criteria and can both aid the understanding and communication of the complexity of the problem situation.



## **Chapter 8 – Conclusion and Future Work**

### **8.1 – Introduction**

This thesis has presented the concept of a new methodological framework for policy design and analysis for use in the development of public policy. Its focus has been on a thorough investigation into the problem space to establish the context and identify the problems as they *actually* are rather than what they are *perceived* to be. This chapter considers future work and, in doing so discusses the limitations of the completed work. This chapter also summarises the framework by revisiting the objectives identified in Chapter 1 and concludes with a discussion on the key achievements and contribution in the field of policy informatics and public policy decision-making.

### **8.2 – Future Work**

The work undertaken and presented in this thesis focussed on the creation of a methodological framework for policy design and analysis that addresses issues with problem framing, problem identification and problem investigation. This meant, the latter stages of the proposed framework have not been fully developed or tested. This, while perhaps a limitation of the work completed, also presents an opportunity for future developments. Among other limitations is the limited access to all the data required to fully test all aspects of the framework, as the existing data sets do not necessarily meet the information needs identified in the models. Having said that, the fact that the models identify information needs that differ from those currently collected, could be viewed as validating the need for a more robust and

thorough investigation into the problem space. This is to ensure that the data being collected and, often used as performance measures, is 'fit for purpose'. The models produced and presented in this thesis have not only identified information needs but also provided clarity in the rationale for the associated data collections.

Discussions with the Deputy Director of Health Policy in Wales has also produced opportunities for further development of the framework and its utilisation in real terms, particularly in the formulation of policies within the Wales Ambulance Service. This would mean that the limitations with access to appropriate validation data will be addressed.

### **8.3 – Progress against Thesis Objectives**

The researcher's work on the project followed the six objectives presented in Chapter 1. Initially objectives 1 and 2 were reasonably well defined as they were concerned with gaining a deep understanding of the domain. The findings of these two objectives identified the initial versions of objectives 3 to 6. Throughout the research the objectives were refined as greater insight into the domain was achieved. This was an iterative process with the later objectives becoming clearer as the research progressed. The initial intention was to develop and test a complete framework. However, the work on objectives 1 and 2 revealed that the linear structure of the traditional cyclical policy decision making models was not capable of addressing the complexity and were consequently simplifying the problem by not investigating whether the problem had been fully identified. Thus, the models were accepting that the problem as given was an accurate reflection of the true underlying

problem. No attempts were being made to reconcile conflicts occurring between different parts of the organisation as to how to create the policy. This led to a realisation that only a fuller investigation of the problem in stage 1 of the cyclical models would improve the situation. This deeper investigation became the dominant focus of the research undertaken to create the new framework. This was confirmed in objective 3 which showed tools such as SSM and SD or rather a synthesis of the two would be needed to address the complexity and identify the inherent unintended consequences of implementing policy actions. The true nature of the problems would be revealed using SSM and SD and unintended consequences would be revealed by using SD. Using the synthesis of SSM and SD to investigate the problem domain could address the complexity and resolve conflicts. When these tools were used on the case studies, they showed the limitations of the current approaches. SD identified loop structure showing a system that was out of control in the Mid-Staffordshire hospital case study. Applying SD showed that unintended consequences occurred when the problem was not tackled holistically. Applying SSM in a 'greenfield' situation in the EWA case study allowed policies, processes and working practices to be identified as meaningful activity to achieve the organisation's core purpose. This 'core purpose' was defined using a participatory approach where the multiple perspectives were all considered, which is an approach fully supported using SSM and Enterprise Modelling.

As expected, when the new framework was used on the Child Protection case study and compared with the work by Munroe, different objectives were revealed, and it showed where unintended consequences might occur. It

also enabled the understanding of where policy action in one part of the system impacts on other parts of the system.

This demonstrated that applying the new framework had given greater insight into how to design policy action to address the real problem which is achieved by a more thorough investigation into the problem at the start.

## **8.4 – Contribution to Research**

To summarise, the work presented in this thesis, has shown:

- Previous research in the field of policy design and analysis, identify frameworks which did not offer a clear methodological choice to complete the steps contained in those frameworks.
- It is possible to create a complete methodological framework for policy design and analysis that provides a detailed and thorough investigation into the public policy problem space.
- Independent evaluation of the created framework against more traditional cyclical frameworks demonstrated its usefulness in dealing with complexity, conformity, changeability and visibility.
- The comparison with models created using a similar methodological choice demonstrated where the multimethodology approach adds clarity to the rationale for policy action and information collection.
- A better understanding of the problem situation is achieved, and the complexity is successfully understood and communicated.

This framework shows clear advances over previous work. They are:

- Improved conceptual modelling using a multi-model method providing a better representation of the application domain gives clarity and understanding
- Demonstration of the applicability of the multi-model method to three case studies showed its generality and efficacy
- Demonstration of the commercial and sociological improvement and benefit to the use case owner/organisation achieved by the method in three case studies
- Provision of a methodology for validating the results of (public) inquiry in at least one domain as demonstrated in case study 1 (chapter 6, section 6.1) and likely to be applicable in others

The work in this thesis therefore makes several contributions in several areas including; System Dynamics, Policy Science, Policy Informatics and Child Protection. The contribution to System Dynamics was also the focus of the following paper:

Teehan, C. & McIntosh, S., 2012. Validating the Outcome of Formal (Public) Inquiries Using System Dynamics – A Case Study. In *International System Dynamics Conference 2012*. St.Gallan, pp. 1–14.

## References:

- Ackermann, F. & Eden, C., 2010. Strategic Options Development and Analysis. In M. Reynolds & S. Holwell, eds. *Systems Approaches to Managing Change: A Practical Guide*. London: Springer London, pp. 135–190. Available at: [http://dx.doi.org/10.1007/978-1-84882-809-4\\_4](http://dx.doi.org/10.1007/978-1-84882-809-4_4).
- Anderson, J.E., 2003. The Study of Public Policy. *Public policymaking: An introduction*, pp.1–34.
- Audit Commission, 2007. *Improving information to support decision making: Standards for better quality data*, Available at: <http://www.eurim.org.uk/activities/ig/voi/AuditNov07.pdf>.
- Baines, S., Wilson, R. & Walsh, S., 2010. Seeing the full picture? Technologically enabled multi-agency working in health and social care. *New Technology, Work and Employment*, 25(1), pp.19–33. Available at: <http://doi.wiley.com/10.1111/j.1468-005X.2009.00236.x>.
- Barrett, C. et al., 2011. Information Integration to Support Policy Informatics. *The Innovation Journal*, 16(1), p.article 2.
- Barrett, C.L. et al., 2011. Information integration to support model-based policy informatics. *Innovation Journal*, 16(1), pp.1–16.
- Beer, S., 1984. The Viable System Model: Its Provenance, Development, Methodology and Pathology. *Journal of the Operational Research Society*, 35(1), pp.7–25. Available at: <http://dx.doi.org/10.1057/jors.1984.2>.
- Benoit, F. et al., 2013. Public Policy Models and Their Usefulness in Public Health: The Stages Model. , (October), pp.1–11.
- Beresford, P. & Rajan-Rankin, S., 2011. Critical observations on the Munro Review of Child Protection. *SWAN*. Available at: <http://www.socialworkfuture.org/articles-and-analysis/analysis/sw-taskforce/150-munro-review-critique> [Accessed September 14, 2014].
- Bergval-Kareborn, B., Mirijamdotter, A., Basden, A., 2004. Basic Principles of SSM Modeling: An Examination of CATWOE from a Soft Perspective. *Systemic Practice and Action Research*, 17(2), pp 55-73
- Bernstein, J.H., 2011. The Data-Information-Knowledge-Wisdom Hierarchy and its Antithesis. In *Nasko*. pp. 68–75. Available at: <http://journals.lib.washington.edu/index.php/nasko/article/view/12806>.
- Boscarino, J.E., 2009. Surfing for problems: Advocacy group strategy in U.S. forestry policy. *Policy Studies Journal*, 37(3), pp.415–434.
- Brandon, M. et al., 2010. A study of recommendations arising from serious case reviews 2009-2010. *Department for Education*.
- Cairney, P. & Jones, M.D., 2016. Kingdon's Multiple Streams Approach: What Is the Empirical Impact of this Universal Theory? *Policy Studies Journal*, 44(1),

pp.37–58.

Checkland, P., 1995. Model Validation in Soft Systems Practice. *Systems Research*, 12(1), pp.47–54.

Checkland, P., 1981. *Systems Thinking, Systems Practice*, Chichester: Wiley.

Cooper, C.L., 2001. *Organisational Stress: A Review and Critique of Theory, Research, and Applications*, London: Sage Publications.

Cooper, C.L., 1998. *Theories of Organisational Stress*, Oxford: Oxford University Press.

Coyle, G., 2000. Qualitative and quantitative modelling in system dynamics: some research questions. *System Dynamics Review Autumn*, 16(3), pp.225–244.

Coyle, R.G., 1996. *System Dynamics Modelling: A Practical Approach, Volume 1*, London: Chapman & Hall/CRC.

Davies, N., Atkins, G., & Slade, D. (2018). How to transform infrastructure decision making in the UK. 2018-02, 1–29.

Dawes, S.S. & Helbig, 2015a. The Value and Limits of Government Information Resources for Policy Informatics. *Governance in the Information Era: Theory and Practice of Policy Informatics*, (March).

Dawes, S.S. & Helbig, 2015b. The Value and Limits of Government Information Resources for Policy Informatics. *Governance in the Information Era: Theory and Practice of Policy Informatics*, (March). Available at: <https://books.google.com/books?id=IHHABgAAQBAJ>.

Desouza, K.C., 2011. Defining Policy Informatics. Available at: <http://kevindesouza.net/2011/08/defining-policy-informatics/> [Accessed March 26, 2015].

Eisenhardt, K.M., 2016. Building Theories from Case Study Research Published by : Academy of Management Stable URL : <http://www.jstor.org/stable/258557> Linked references are available on JSTOR for this article : Building Theories from Case Study Research. , 14(4), pp.532–550.

Exworthy, M., 2008. Policy to tackle the social determinants of health: Using conceptual models to understand the policy process. *Health Policy and Planning*, 23, pp.318–327.

Fischer, F., Miller, G.J. & Sidney, M.S., 2007. Handbook of public policy analysis : theory, politics, and methods. *Methods*, 125, p.642 S.

Flyvbjerg, B., 2016. Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12, pp.219–245.

Forrester, J.W., 1961. *Industrial Dynamics*, Cambridge, Mass.: MIT Press.

Forrester, J.W. & Senge, P.M., 1980. Tests for Building Confidence in System Dynamics Models. In A. A. Legasto, J. W. Forrester, & J. Lyneis, eds. *System Dynamics*. Amsterdam: North Holland.

- Friend, J. & Hickling, A., 2005. *Planning Under Pressure: The Strategic Choice Approach* Third., London.
- Georgiou, I., 2012. Messing about in transformations: Structured systemic planning for systemic solutions to systemic problems. *European Journal of Operational Research*, 223(2), pp.392–406. Available at: <http://dx.doi.org/10.1016/j.ejor.2012.06.010>.
- Ghaffarzadegan, N., Lyneis, J. & Richardson, G.P., 2015. Policy Informatics with Small System Dynamics Models: How Small Models Can Help the Public Policy Process. *Governance in the information Era: Theory and practice of policy informatics*, pp.144–160.
- Gokhale, G.B., 2002. Organisational Information Security : A Viable System Perspective INFORMATION SECURITY & THREATS. , 17799.
- Gummesson, E., 2000. *Qualitative methods in management research*. Sage. California
- Hallsworth, M., 2011a. Policy Making in the Real World. *Political Insight*. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/j.2041-9066.2011.00051.x/full>.
- Hallsworth, M., 2011b. *System Stewardship: The Future of Policy Making?*, Available at: [http://www.instituteforgovernment.org.uk/sites/default/files/publications/System Stewardship.pdf](http://www.instituteforgovernment.org.uk/sites/default/files/publications/System%20Stewardship.pdf) [Accessed August 12, 2015].
- Hallsworth, M. & Rutter, J., 2011. *Making Policy Better: Improving Whitehall's core business*, Available at: <http://www.instituteforgovernment.org.uk/publications/making-policy-better>.
- Hanberger, A., 2001. What is the policy problem? *Evaluation*, 7(1), pp.45–62.
- Hardy, S.D. & Koontz, T.M., 2009. Rules for collaboration: Institutional analysis of group membership and levels of action in watershed partnerships. *Policy Studies Journal*, 37(3), pp.393–414.
- Helbig, N., Nakashima, M. & Dawes, S.S., 2012. Understanding the value and limits of government information in policy informatics. *Proceedings of the 13th Annual International Conference on Digital Government Research - dg.o '12*, p.291. Available at: <http://dl.acm.org/citation.cfm?id=2307729.2307790>.
- HM Government, 2013. *Twelve Actions to Professionalise Policy Making: A report by the Policy Profession Board*,
- HM Treasury & Treasury, H.M., 2003. Appraisal and Evaluation in Central Government. *Evaluation*, (October 2002), p.118. Available at: [http://www.hm-treasury.gov.uk/d/green\\_book\\_complete.pdf](http://www.hm-treasury.gov.uk/d/green_book_complete.pdf).
- Hood, C., 1991. A new public management for all seasons. *Public Administration*, 69, pp.3–19.
- Houghton, L. & Tuffley, D., 2015. Towards a Methodology of Wicked Problem



- Exploration through Concept Shifting and Tension Point Analysis. *Systems Research and Behavioral Science*, 32, pp.283–297. Available at: <http://doi.wiley.com/10.1002/sres.2223>.
- Howick, S. & Ackermann, F., 2011. Mixing or methods in practice: Past, present and future directions. *European Journal of Operational Research*, 215(3), pp.503–511. Available at: <http://dx.doi.org/10.1016/j.ejor.2011.03.013>.
- Hoyle, D., 2008. problematizing every child matters. *Infed*. Available at: [http://www.infed.org/socialwork/every\\_child\\_matters\\_a\\_critique.htm](http://www.infed.org/socialwork/every_child_matters_a_critique.htm) [Accessed November 10, 2011].
- Jackson, M.C., 2006. Beyond problem structuring methods: reinventing the future of OR/MS. *Journal of the Operational Research Society*, 57, pp.868–878. Available at: <http://www.scopus.com/inward/record.url?eid=2-s2.0-33745535964&partnerID=40&md5=7df3c96848aad72f05d5446478d505a1%5Cnhttp://dx.doi.org/10.1057/palgrave.jors.2602093>.
- Johnson, D., 1984. *Research Methods in Education Management Research*. Longman Group. Essex
- Johnson, E. w., 2015. *Governance in the Information Era: Theory and Practice of Policy Informatics*, Oxon: Routledge.
- Jones, B.D. & Baumgartner, F.R., 2005. A model of choice for public policy. *Journal of Public Administration Research and Theory*, 15(3), pp.325–351.
- Jones, M.D. & McBeth, M.K., 2010. A Narrative Policy Framework: Clear Enough to Be Wrong? *Policy Studies Journal*, 38(January), pp.329–353.
- Keller, K. & Staelin, R., 1987. Effects of Quality and Quantity of Information on Decision Effectiveness. *Journal of Consumer Research*, 14(2), pp.200–213.
- Kendrick, A., 2004. Recent Developments in Child Protection Policy and Practice in Scotland and the UK. In *Coping with Child Maltreatment - Prevention and Intervention: International Overview*. pp. 1–10.
- Kim, Y. & Johnston, E.W., 2008. Policy Informatics v1.0. In pp. 0–22.
- King, A. & Crewe, I., 2013. *The Blunders of Our Government*, Oneworld Publications, London
- Kiser, L.L. & Ostrom, E., 1982. The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches. In *Strategies of Political Inquiry*. Beverly Hills: Sage.
- Krueger, Gerald, P., 1989. Sustained work, fatigue, sleep loss and performance: A review of the issues. *Work & Stress*, 3(2), pp.129–141.
- Laming, Lord, 2003. *VICTORIA CLIMBIÉ Public Inquiry Report*,
- Lane, D.C. & Olivia, R., 1998. The greater whole: towards a synthesis of system dynamics and soft systems methodology. , 2217(97). Available at: <http://eprints.lse.ac.uk/20821/>.

- Lee, Y.W. et al., 2002. AIMQ: A methodology for information quality assessment. *Information and Management*, 40(2), pp.133–146.
- Lubell, M., Henry, A.D. & McCoy, M., 2010. Collaborative Institutions in an Ecology of Games. *American Journal of Political Science*, 54(2), pp.287–300.
- Luna-Reyes, L.F. et al., 2007. Emergence of the governance structure for information integration across governmental agencies: a system dynamics approach. *8th Annual International Conference on Digital Government Research (dg.o 2007)*, 228, pp.47–56.
- MacDonald, W., 2003. The impact of job demands and workload on stress and fatigue. *Australian Psychologist*, 38(2), pp.102–117.
- Mcnutt, K. & Rayner, J., 2010. March 2010. In *European Consortium for Political Research*. Munster, pp. 1–31.
- Miguel, J., Mauricio, D., & Rodríguez, G. (2014). A Review of Software Quality Models for the Evaluation of Software Products. *International Journal of Software Engineering & Applications*, 5(6), 31–53.  
<https://doi.org/10.5121/ijsea.2014.5603>
- Miljan, L., 2012. Theories of Public Policy. *Public Policy in Canada*, pp.23–50.
- Mingers, J., 2008. Working Paper Series. , 7595(172), pp.1–29.
- Mingers, J. & White, L., 2010. A review of the recent contribution of systems thinking to operational research and management science. *European Journal of Operational Research*, 207(3), pp.1147–1161. Available at: <http://dx.doi.org/10.1016/j.ejor.2009.12.019>.
- Munro, E., 2011. *The Munro Review of Child Protection : The Munro Review of Child Protection : Final Report*,
- Naccarato, T., 2010. Child welfare informatics: A proposed subspecialty for social work. *Children and Youth Services Review*, 32(12), pp.1729–1734. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0190740910002173> [Accessed May 31, 2012].
- Naylor, T.H. & Finger, J., 1967. Verification of Computer Simulation Models. *Management Science*, 14(2), p.92=101.
- Nowlin, M.C., 2011. Theories of the Policy Process : State of the Research and. *Policy Studies*, 39(2007), pp.41–60. Available at: [http://onlinelibrary.wiley.com/doi/10.1111/j.1541-0072.2010.00389\\_4.x/full](http://onlinelibrary.wiley.com/doi/10.1111/j.1541-0072.2010.00389_4.x/full).
- Orphanides, A., 2001. Monetary Policy Rules Based on Real-Time Data. *The American Economic Review*, 91(4), pp.964–985.
- Parsons, W., 2002. From Muddling Through to Muddling Up - Evidence Based Policy Making and the Modernisation of British Government. *Public Policy and Administration*, 17(3), pp.43–60.
- Peterson, S. O. (2003). Barry Richmond, System Dynamics and Public Policy.

*Proceedings of the 21st International Conference of the System Dynamics Society*, 1–14.

Perrow, C., 1984. *Normal Accidents: Living with High-Risk Technologies*, New York, New York, USA: Basic Books.

Pritchard, H., 2016. The numbers that show Wales' "opt-out" organ donation system is saving lives. *Wales Online*. Available at: <http://www.walesonline.co.uk/news/health/numbers-show-wales-opt-out-11468872>.

Punj, G. & Srinivasan, N., 1992. Influence of Problem Recognition on Search and Other Decision Process Variables: a Framework For Analysis. *Advances in Consumer Research*, 19, pp.491–497.

Quade, E.S.S., 1969. The System Approach and Public Policy. , pp.1–33.

Revere, L. & Black, K., 2003. Integrating Six Sigma with Total Quality Management: A Case Example for Measuring Medication Errors. *Journal of Healthcare Management*, 48, pp.377–391.

Reynolds, M., Holwell, S. & Beer, S., 2010. Systems Approaches to Managing Change: A Practical Guide. Available at: <http://link.springer.com/10.1007/978-1-84882-809-4>.

Rigby, M. et al., 2009. Social Care Informatics – The Missing Partner in eHealth. *Medical Informatics in a United and Healthy Europe*, pp.277–281.

Rigby, M. & Hill, M.P., 2010. *The Challenges of Developing Social Care Informatics as an Essential Part of Holistic Health Care : Report of an ESF Exploratory Workshop held at Keele University on 21-23 July 2010 and Declaration drafted by Workshop Members Convener and Report Editor*, Available at: [http://www.esf.org/index.php?eID=tx\\_nawsecuredl&u=0&file=fileadmin/be\\_user/ew\\_docs/09-021\\_Report.pdf&t=1366970804&hash=de1c77a3ae5473991da256bba8c94c75fecd03d3](http://www.esf.org/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/be_user/ew_docs/09-021_Report.pdf&t=1366970804&hash=de1c77a3ae5473991da256bba8c94c75fecd03d3).

Robinson, S.E. & Eller, W.S., 2010. Participation in policy streams: Testing the separation of problems and solutions in subnational policy systems. *Policy Studies Journal*, 38(2), pp.199–216.

Rodriguez-Ulloa, R. & Paucar-Caceres, A., 2005. Soft System Dynamics Methodology (SSDM): Combining Soft Systems Methodology (SSM) and System Dynamics (SD). *Systemic Practice and Action Research*, 18(3), pp.303–334.

Rouwette, E., Bastings, I. & Blokker, H., 2011. A Comparison of Group Model Building and Strategic Options Development and Analysis. *Group Decision and Negotiation*, 20(6), pp.781–803. Available at: <http://dx.doi.org/10.1007/s10726-010-9207-5>.

Sargent, R., 2009. Verification and validation of simulation models. *Proceedings of the 2009 Winter Simulation Conference*, 37, pp.162–176. Available at:

- <http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=5235461>.
- Schaffernicht, M., 2007. Causality and diagrams for system dynamics. In *International System Dynamics Conference 2007*.
- Schmitz, A., 2012. *Human Relations*, Saylor Academy.
- Schraer, R., 2015. Social worker stress costing councils at least £45m in lost labour. *Community Care*.
- Sills, D., Wolf, C. & Shelanski, V., 1981. *The Accident at Three Miles Island: The Human Dimensions*, Boulder: Westview Press.
- Stewart, J. & Ayres, R., 2001. Systems theory and policy practice: An exploration. *Policy Sciences; Mar*, 34(1), pp.79–94.
- Street, R., World Resources Report. *World Resrouces Institute*. Available at: <http://www.wri.org/our-work/project/world-resources-report/what-types-information-are-needed-adaptation-decision-making>. [Accessed November 2, 2015]
- Taylor, A., 2008. Baby P case professionals' lack of confidence highlights need to challenge criticisms - The Social Work Blog. *Community Care*. Available at: <http://www.communitycare.co.uk/blogs/social-work-blog/2008/11/baby-p-case-professionals-lack/> [Accessed October 30, 2014].
- True, J., Jones, B. & Baumgartner, F., 2006. Punctuated-Equilibrium Theory Explaining Stability and Change in Public Policymaking. In P. Sabatier, ed. *Theories of the Policy Process, 2nd Edition*. pp. 1–58.
- Waldman, J.D., 2007. Thinking systems need systems thinking. *Systems Research and Behavioral Science*, 24, pp.271–284.
- Walsh, S. et al., 2012. “You”re Just Treating Us as Informants!’ Roles, Responsibilities and Relationships in the Production of Children’s Services Directories. *Local Government Studies*, (May), pp.1–20. Available at: <http://www.tandfonline.com/doi/abs/10.1080/03003930.2012.676439> [Accessed May 25, 2012].
- Welsh Assembly Government, 2011. Sustainable Social Services for Wales: A Framework for Action, 33
- Wiess, J., 2011. The Powers of Problem Definition : The Case of Government Paperwork. *Policy Sciences;*, 22(2), pp.97–121.
- Wilson, R. et al., 2011. Re-Mixing Digital Economies in the Voluntary Community Sector? Governing Identity Information and Information Sharing in the Mixed Economy of Care for Children and Young People\*. *Social Policy and Society*, 10(3), pp.379–391. Available at: [http://www.journals.cambridge.org/abstract\\_S1474746411000108](http://www.journals.cambridge.org/abstract_S1474746411000108) [Accessed May 25, 2012].
- Wolstenholme, E., 2004. Using generic system archetypes to support thinking and modelling. *System Dynamics Review*, 20(4), pp.341–356. Available at:

<http://doi.wiley.com/10.1002/sdr.302> [Accessed July 5, 2011].

Woolley, R. & Pidd, M., 1981. Problem Structuring - A Literature Review. *The Journal of the Operational Research Society*, 32(3), pp.197–206.

Yin, R., 1984. Case Study Research: Design and Methods. Sage. California

Yin, R., 1993. Application of Case Study Research. Sage. California

Zahariadis, N., 2008. Ambiguity and choice in European public policy. *Journal of European Public Policy*, 15(October 2013), pp.514–530.

## **Appendix A – Small Individual Conceptual Models**

**Created from the Root Definitions for Child Protection**

T - A system operated by child protection teams, to ensure the physical, mental and moral well-being of school-age children in Wales though the provision of a range of intervention and/or support services appropriate to the justified suspicions that identifies a child as 'in need' or 'in need of protection', while complying with relevant legal constraints and reflecting the need to justify and record all decisions, and ensuring that the rights of the individual and close family members are maintained, and that the individual's wishes are accommodated where safe and appropriate to do so.

S1 – A system to ensure the physical resources available to child protection teams, including relevant third parties match those required to support all activities including the exploitation of the latest of technological developments as a means of enhancing performance.





S2 – A system to ensure the human resources available to child protection teams, including relevant third parties match those required to complete all activities through the acquisition, disposal and development of staff through appropriate learning programmes that support the defined roles whilst adhering to relevant employment legislation.



S3 – A system to develop and maintain a culture and working environment that allows relevant personnel and other associated bodies to exercise initiative in the development of policies and working practices that contribute to the greater effectiveness of child protection, the freedom to challenge current policies and processes, and facilitate the identification of areas of potential improvement.



S4 – A system to maintain the availability of those channels of communication of appropriate characteristics across the organisational and geographical structure of the child protection teams and other associated bodies, so that information relevant to a child's needs can be exchanged as required to facilitate appropriate decision making, about how to react to, or pre-empt, events or justified suspicions, and to achieve clarity of purpose and efficiency of operation, to the satisfaction of relevant stakeholders.





S6 – A system to ensure that sufficient funds are available to support the provision of the defined services to the required standards to meet client needs and expectations through the acquisition of central funds while adopting derived priorities in the event of any shortfall and constraints on borrowing.

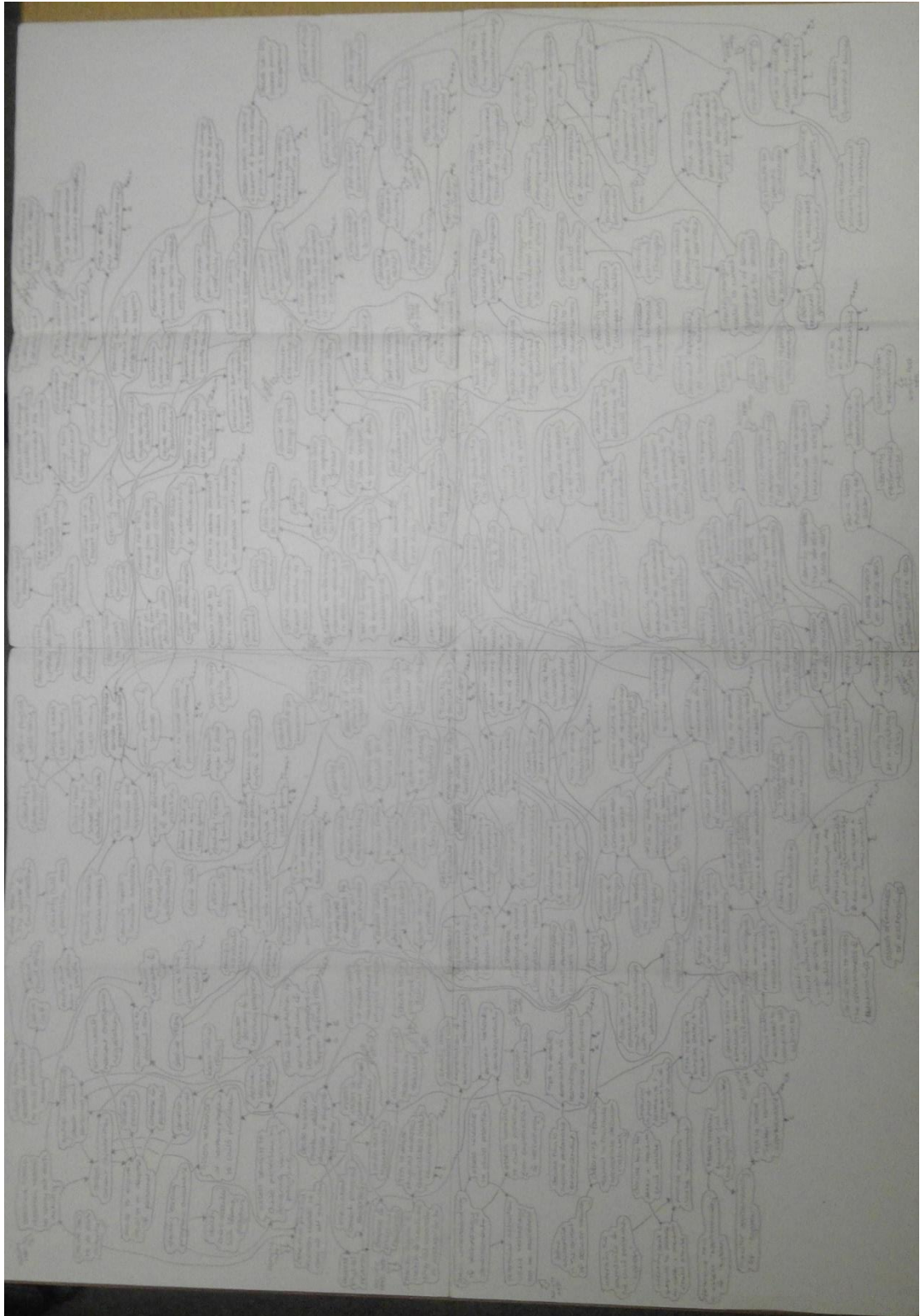


```

graph TD
    A[define total constraints] --> B[assess impact on all activities]
    A --> C[assemble activity constraint information]
    B --> D[decide how to react]
    B --> E[assess degree of conformance]
    D --> F[notify each controller]
    E --> G[TCA to ensure conformance achieved]
    F --> H[identify development plan timescale]
    G --> I[execute development plan]
    I --> J[formulate policies]
    I --> K[formulate development plans]
    J --> L[assess relevance to child protection]
    K --> M[identify process required to execute plans]
    L --> N[identify political changes]
    M --> O[identify legal, economic + social changes in Wales]
    N --> J
    O --> J
  
```

The flowchart illustrates the process of formulating development plans and associated policies for Wales. The process begins with 'define total constraints', which is influenced by 'know about available finance', 'define economic considerations', 'define legal considerations', 'define social considerations', and 'define ethical considerations'. This leads to 'assess impact on all activities' and 'assemble activity constraint information'. 'assess impact on all activities' leads to 'decide how to react' and 'assess degree of conformance'. 'decide how to react' leads to 'notify each controller'. 'assess degree of conformance' leads to 'TCA to ensure conformance achieved'. 'notify each controller' leads to 'identify development plan timescale'. 'TCA to ensure conformance achieved' leads to 'execute development plan'. 'execute development plan' leads to 'formulate policies' and 'formulate development plans'. 'formulate policies' leads to 'assess relevance to child protection'. 'formulate development plans' leads to 'identify process required to execute plans'. 'assess relevance to child protection' leads to 'identify political changes'. 'identify process required to execute plans' leads to 'identify legal, economic + social changes in Wales'. 'identify political changes' and 'identify legal, economic + social changes in Wales' both lead to 'formulate policies'.

## Appendix B – Full size Consensus Primary Task Model



## **Appendix C – The Equations Created for the HR Management and Case Management Simulation Models**

### **Equations for HR Management Model**

$$\text{Average\_Days\_Lost\_Through\_Absence[absence]}(t) =$$
$$\text{Average\_Days\_Lost\_Through\_Absence[absence]}(t - dt) +$$
$$(\text{going\_absent[absence]} - \text{returning\_from\_absence[absence]}) * dt$$

$$\text{INIT Average\_Days\_Lost\_Through\_Absence[absence]} = 0$$

INFLOWS:

$$\text{going\_absent[sick\_leave]} = (\text{NEW\_BASE}/100) * \text{sick\_absence\_rate}$$

$$\text{going\_absent[annual\_leave]} = (\text{NEW\_BASE}/100) * \text{annual\_leave\_rate}$$

$$\text{going\_absent[other\_leave]} = (\text{NEW\_BASE}/100) * \text{other\_absence\_rate}$$

OUTFLOWS:

$$\text{returning\_from\_absence[sick\_leave]} = \text{CONVEYOR OUTFLOW}$$

$$\text{TRANSIT TIME} = \text{avg\_number\_of\_days\_sick\_absence}$$

$$\text{returning\_from\_absence[annual\_leave]} = \text{CONVEYOR OUTFLOW}$$

$$\text{TRANSIT TIME} = \text{avg\_number\_of\_day\_AL\_absence}$$

$$\text{returning\_from\_absence[other\_leave]} = \text{CONVEYOR OUTFLOW}$$

$$\text{TRANSIT TIME} = \text{avg\_number\_of\_dys\_other\_absence}$$

$$\text{Total\_Number\_of\_Social\_Workers}(t) = \text{Total\_Number\_of\_Social\_Workers}(t - dt) + (\text{gaining\_staff} - \text{losing\_staff}) * dt$$

$$\text{INIT Total\_Number\_of\_Social\_Workers} = \text{workers\_available}$$

INFLOWS:



gaining\_staff =  
 (returning\_from\_absence[sick\_leave]+returning\_from\_absence[annual\_leave  
 ]+returning\_from\_absence[other\_leave])/5

OUTFLOWS:

losing\_staff =  
 (going\_\_absent[sick\_leave]+going\_\_absent[annual\_leave]+going\_\_absent[ot  
 her\_leave])/5

Total\_Number\_Social\_Workers\_Needed(t) =  
 Total\_Number\_Social\_Workers\_Needed(t - dt) + (need\_\_growing -  
 need\_\_dissipating) \* dt

INIT Total\_Number\_Social\_Workers\_Needed =  
 ((total\_SW\_positions/100)\*vacancy\_rate)-agency\_vacancy\_cover

INFLOWS:

need\_\_growing = caseload\_driven\_need+losing\_staff

OUTFLOWS:

need\_\_dissipating = gaining\_staff+hiring\_\_staff

Total\_Social\_\_Worker\_Vacancies(t) = Total\_Social\_\_Worker\_Vacancies(t -  
 dt) + (staff\_\_need - hiring\_\_staff) \* dt

INIT Total\_Social\_\_Worker\_Vacancies =  
 ((total\_SW\_positions/100)\*vacancy\_rate)-agency\_vacancy\_cover

INFLOWS:

staff\_\_need = (((NEW\_BASE/100)\*turnover\_rate)-  
 agency\_vacancy\_cover)+Total\_Number\_Social\_Workers\_Needed

OUTFLOWS:

hiring\_\_staff = (NEW\_BASE/100)\*hiring\_rate

agency\_cover\_rate = vacancy\_rate-2

agency\_vacancy\_cover = (VACANCIES/100)\*agency\_cover\_rate

annual\_leave\_rate = 12.07

avg\_number\_of\_days\_sick\_absence = IF  
(rate\_of\_sick\_absence\_due\_to\_stress) < 10 THEN (RANDOM(1,10)) ELSE  
IF (rate\_of\_sick\_absence\_due\_to\_stress>10 AND  
rate\_of\_sick\_absence\_due\_to\_stress<15)THEN (RANDOM(5,15))ELSE IF  
(rate\_of\_sick\_absence\_due\_to\_stress>15 AND  
rate\_of\_sick\_absence\_due\_to\_stress<30)THEN  
(RANDOM(15,20))ELSE(RANDOM(20,60))

avg\_number\_of\_dys\_other\_absence = RANDOM(1,5)

avg\_number\_of\_\_day\_AL\_absence = RANDOM(1,10)

caseload\_driven\_need =

IF(Case\_\_Management.case\_driven\_need\_for\_social\_workers>Case\_\_Man  
agement.acceptable\_case\_level)THEN(Case\_\_Management.case\_driven\_n  
eed\_for\_social\_workers)ELSE (0)

hiring\_rate = 10

NEW\_BASE = total\_SW\_positions-VACANCIES

other\_absence\_rate = 1.2

rate\_of\_sick\_absence\_due\_to\_stress =  
IF(Case\_\_Management.acceptable\_case\_level>40)THEN(40)ELSE  
IF(Case\_\_Management.acceptable\_case\_level>30 AND  
Case\_\_Management.acceptable\_case\_level<=40)THEN(30)ELSE  
IF(Case\_\_Management.acceptable\_case\_level<30 AND  
Case\_\_Management.acceptable\_case\_level>=20)THEN (15)ELSE(10)

sick\_absence\_rate =

IF(rate\_of\_sick\_absence\_due\_to\_stress)=(40)THEN(8.7)ELSE IF  
(rate\_of\_sick\_absence\_due\_to\_stress=30)THEN(7.7)ELSE IF  
(rate\_of\_sick\_absence\_due\_to\_stress=15)THEN(6.7)ELSE(4.7)

$\text{time\_available\_per\_SW\_per\_case} =$   
 $\text{Case\_Management.cases\_per\_social\_worker}/450$   
 $\text{total\_SW\_positions} = 3400$   
 $\text{turnover\_rate} = 16$   
 $\text{VACANCIES} = (\text{total\_SW\_positions}/100) * \text{vacancy\_rate}$   
 $\text{vacancy\_rate} = \text{RANDOM}(21,24)$   
 $\text{workers\_available} = \text{agency\_vacancy\_cover} + \text{NEW\_BASE}$

### Equations for Case Management Model

$\text{Allocated\_to\_Other\_Worker}(t) = \text{Allocated\_to\_Other\_Worker}(t - dt) +$   
 $(\text{moving\_to\_other\_worker\_allocation} - \text{closing\_cases\_from\_other}) * dt$

INIT Allocated\_to\_\_Other\_Worker = 0

INFLOWS:

$\text{moving\_to\_other\_worker\_allocation} =$   
 $((\text{Strategy\_Discussion}/100) * \text{other\_allocation\_}) + ((\text{waiting\_for\_initial\_assessment}/100) * \text{other\_allocation\_})$

OUTFLOWS:

$\text{closing\_cases\_from\_other} =$   
 $(\text{Allocated\_to\_Other\_Worker} * \text{closure\_rate}) / 100$

$\text{Allocated\_to\_Social\_Worker}(t) = \text{Allocated\_to\_Social\_Worker}(t - dt) +$   
 $(\text{receiving\_help} - \text{closing\_cases\_from\_SW}) * dt$

INIT Allocated\_to\_\_Social\_Worker = 0

INFLOWS:

$\text{receiving\_help} =$   
 $(\text{Strategy\_Discussion} * (\text{SW\_allocation\_}/100)) + (\text{waiting\_for\_initial\_assessment} * (\text{SW\_allocation\_}/100))$

OUTFLOWS:

$\text{closing\_cases\_from\_SW} = (\text{Allocated\_to\_Social\_Worker} * \text{closure\_rate}) / 100$

$\text{Cases\_Dropped}(t) = \text{Cases\_Dropped}(t - dt) + (\text{case\_dropped}) * dt$

INIT Cases\_Dropped = 0

INFLOWS:

case\_dropped = LEAKAGE OUTFLOW

$\text{LEAKAGE FRACTION} = \text{case\_drop\_} \% / 100$

NO-LEAK ZONE = 0

$\text{Cases\_Closed}(t) = \text{Cases\_Closed}(t - dt) + (\text{closing\_cases\_from\_SW} + \text{closing\_cases\_from\_other}) * dt$

INIT Cases\_Closed = 0

INFLOWS:

$\text{closing\_cases\_from\_SW} = (\text{Allocated\_to\_Social\_Worker} * \text{closure\_rate}) / 100$

$\text{closing\_cases\_from\_other} = (\text{Allocated\_to\_Other\_Worker} * \text{closure\_rate}) / 100$

$\text{Core\_Assessment}(t) = \text{Core\_Assessment}(t - dt) + (\text{waiting\_for\_core\_assessment} - \text{moving\_to\_strategy} - \text{case\_dropped}) * dt$

INIT Core\_Assessment = 0

TRANSIT TIME = 35

INFLOW LIMIT = INF

CAPACITY = INF

INFLOWS:

waiting\_for\_core\_assessment = CONVEYOR OUTFLOW

OUTFLOWS:

moving\_to\_strategy = CONVEYOR OUTFLOW

case\_\_dropped = LEAKAGE OUTFLOW

LEAKAGE FRACTION = case\_drop\_%/100

NO-LEAK ZONE = 0

Initial\_Assessment(t) = Initial\_Assessment(t - dt) +  
(waiting\_for\_initial\_assessment - waiting\_for\_\_core\_assessment -  
dropped\_\_from\_service) \* dt

INIT Initial\_Assessment = 0

TRANSIT TIME = 7

INFLOW LIMIT = INF

CAPACITY = INF

INFLOWS:

waiting\_for\_initial\_assessment = Received\_\_Referrals-action\_\_unnecessary

OUTFLOWS:

waiting\_for\_\_core\_assessment = CONVEYOR OUTFLOW

dropped\_\_from\_service = LEAKAGE OUTFLOW

LEAKAGE FRACTION = dropped\_from\_service\_%/100

NO-LEAK ZONE = 0

No\_\_Further\_\_Action(t) = No\_\_Further\_\_Action(t - dt) +  
(action\_\_unnecessary + dropped\_\_from\_service) \* dt

INIT No\_\_Further\_\_Action = 0

INFLOWS:

action\_\_unnecessary = Received\_\_Referrals\*(no\_action\_%/100)

dropped\_\_from\_service = LEAKAGE OUTFLOW

LEAKAGE FRACTION = dropped\_from\_service\_/100

NO-LEAK ZONE = 0

Received\_\_Referrals(t) = Received\_\_Referrals(t - dt) + (being\_referred - waiting\_for\_initial\_assessment - action\_\_unnecessary) \* dt

INIT Received\_\_Referrals = 0

INFLOWS:

being\_referred = RANDOM(900,1000)

OUTFLOWS:

waiting\_for\_initial\_assessment = Received\_\_Referrals-action\_\_unnecessary

action\_\_unnecessary = Received\_\_Referrals\*(no\_action\_/100)

Strategy\_\_Discussion(t) = Strategy\_\_Discussion(t - dt) + (moving\_to\_strategy + wait\_list\_moving\_to\_strategy - receiving\_help - children\_waiting - moving\_to\_other\_worker\_allocation) \* dt

INIT Strategy\_\_Discussion = active\_cases

INFLOWS:

moving\_to\_strategy = CONVEYOR OUTFLOW

wait\_list\_moving\_to\_strategy = CONVEYOR OUTFLOW

TRANSIT TIME = RANDOM(57,60)

OUTFLOWS:

receiving\_help = (Strategy\_\_Discussion\*(SW\_allocation\_/100))+(waiting\_for\_initial\_assessment\*(SW\_allocation\_/100))

children\_waiting = (Strategy\_\_Discussion/100)\*waiting\_rate

$$\text{moving\_to\_other\_worker\_allocation} = ((\text{Strategy\_Discussion}/100) * \text{other\_allocation\_}) + ((\text{waiting\_for\_initial\_assessment}/100) * \text{other\_allocation\_})$$

$$\text{Waiting\_for\_Assessment}(t) = \text{Waiting\_for\_Assessment}(t - dt) + (\text{moving\_to\_wait\_list} - \text{wait\_list\_moving\_to\_strategy}) * dt$$

INIT Waiting\_for\_Assessment = 608

TRANSIT TIME = varies

INFLOW LIMIT = INF

CAPACITY = INF

INFLOWS:

$$\text{moving\_to\_wait\_list} = \text{Core\_Assessment} - \text{Strategy\_Discussion}$$

OUTFLOWS:

$$\text{wait\_list\_moving\_to\_strategy} = \text{CONVEYOR OUTFLOW}$$

TRANSIT TIME = RANDOM(57,60)

$$\text{Waiting\_Allocation}(t) = \text{Waiting\_Allocation}(t - dt) + (\text{children\_waiting}) * dt$$

INIT Waiting\_Allocation = 0

INFLOWS:

$$\text{children\_waiting} = (\text{Strategy\_Discussion}/100) * \text{waiting\_rate}$$

acceptable\_case\_level = 16

active\_cases = 12629

$$\text{allocated\_for\_assessment} = (\text{Initial\_Assessment}/100) * \text{allocation\_rate}$$

allocation\_rate = RANDOM(70,80)

$$\text{cases\_per\_social\_worker} = \text{total\_caseload} / \text{HR\_Management.Total\_Number\_of\_Social\_Workers}$$

```

case_driven_need_for_social_workers =
IF(cases_per__social_worker>acceptable_case_level)THEN((total_caseload
-
(acceptable_case_level*HR__Management.Total_Number_of_Social_Worke
rs))/acceptable_case_level)ELSE (0)

case_drop_% = RANDOM(6,12)

closure_rate = RANDOM(5,10)

dropped_from_service_% = RANDOM(2,10)

no_action_% = RANDOM(16,17)

other_allocation_% = RANDOM(8,10)

SW_allocation_% = IF (acceptable_case_level>40) THEN
(RANDOM(40,50)) ELSE IF (acceptable_case_level>30 AND
acceptable_case_level <=40) THEN (RANDOM(50,60)) ELSE IF
(acceptable_case_level>20 AND acceptable_case_level <=30) THEN
(RANDOM(60,70)) ELSE(RANDOM(70,75))

total_caseload =
IF(Allocated_to__Social_Worker<1)THEN(allocated_for_assessment+active
_cases) ELSE ((Allocated_to__Social_Worker+active_cases)-
((Allocated_to__Social_Worker+active_cases)/100)*closure_rate)

unallocated_% = IF(SW_allocation_%+other_allocation_%)<100 THEN 100-
(other_allocation_%+SW_allocation_%)ELSE 0

waiting_rate = IF (acceptable_case_level>40) THEN (RANDOM(45,55))
ELSE IF (acceptable_case_level>30 AND acceptable_case_level <=40)
THEN (RANDOM(35,45)) ELSE IF (acceptable_case_level>20 AND
acceptable_case_level <=30) THEN (RANDOM(25,35))
ELSE(RANDOM(15,25))

```